

KDHE Agency Response Plan – 2020



# Harmful Algal Blooms

## **KDHE Agency Response Plan**

## **Revision Dates**

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## Cover photo:

South Lake, Johnson County, KS, September 2018, courtesy of Regina Klepikow

## **Table of Contents**

| SECTION 1. PURPOSE  | 6              |
|---|----------------|
| SECTION 2. OVERVIEW   | 7              |
| SECTION 3. KDHE RESPONSIBILITY  | 9              |
| SECTION 4 ADVISORIES  |                |
| 4.1 Criteria for Public Health Protection Levels                      | 15             |
| 4.2 Criteria of Status Change of Advisories                           | 20             |
| SECTION 5. RESPONSE   |                |
| 5.1 Harmful Algal Bloom Response Procedures                           | 21             |
| 5.2 Response Prioritization   | 23             |
| 5.3 Sampling Season   | 29             |
| SECTION 6. SAMPLING   |                |
| 6.1 Sampling Safety   | 31             |
| 6.2 Sample Collection/Sample Locations                                | 33             |
| 6.3 Sample Types/Sample Analysis                                      | 36             |
| SECTION 7: ANNUAL PROGRAM MANAGEMENT                                  | 38             |
| SECTION 8. DATA MANAGEMENT  | 40             |
| WORKS CITED   | 41             |
| APPENDIX A  |                |
| KDHE Policy: Guidelines for Addressing Harmful Algal Blooms in Kansas | s Recreational |
| Waters  | 42             |
| APPENDIX B  |                |
| Notification Signs  | 47             |
| APPENDIX C  |                |
| A Week in a HAB Response  | 57             |
| APPENDIX D  |                |
| KDHE's Harmful Algal Bloom Response Procedures Flow Chart             | 61             |
| APPENDIX E  |                |

| Algae Submission Form/ Chain of Custody                                 | 64  |
|---|-----|
| APPENDIX F Public Water Supply  | 69  |
| APPENDIX G Public Health Release Example                                | 79  |
| APPENDIX H  Jar and Stick Tests   | 82  |
| APPENDIX I Taxonomic Analysis Priority                                  | 89  |
| APPENDIX J Standard Operating Procedures for Algal Samples              | 91  |
| APPENDIX K  Lake Visitation Potential                                   | 106 |
| APPENDIX L Standard Operating Procedures for HAB Data Management System | 118 |
| APPENDIX M Acronyms   | 156 |

# **List of Figures**

| Figure 1. HAB Response Timeline   | 21 |
|---|----|
| Figure 2. Visitation Potential Formula  | 26 |
| Figure 3. Determining Resampling Frequency for Public Lakes with top 25% for Visitation   |    |
| Potential   | 27 |
| Figure 4. Determining Resampling Frequency for Public Lakes with Lower 75% for Visitation | on |
| Potential   | 28 |
|   |    |
| List of Tables  |    |
| Table 1. Lake Status Determination  | 19 |
| Table 2. Priority Response Timeframe  | 24 |

## **SECTION 1. PURPOSE**

This plan is to provide guidance for Kansas Department of Health and Environment's (KDHE) response to reduce the risk of exposure to humans, pets, and livestock from blue-green algal toxins.

Cyanobacterial toxins (also known as blue-green algal toxins) in freshwaters have been implicated in human and animal illness in at least 38 states in the United States<sup>1</sup>. In Kansas, blue-green algae are naturally present at low densities in most surface waters. When certain conditions develop, such as high nutrient and abundant light levels, these organisms can reproduce rapidly. This dense growth of algae is called a bloom and can sometimes lead to a harmful algal bloom (HAB). These conditions tend to occur in the warmer summer months, after spring rainfalls wash accumulated high nutrient loads into surface waters, derived from animal waste, agricultural fertilizers, sewage effluent, and urban stormwater runoff. Subsequent summer conditions improve water clarity, allowing light to penetrate deeper into waters, fueling primary productivity where nutrients are plentiful. Dry summer conditions can increase the impact of wastewater effluent on lakes and streams, when lower water levels condense nutrients. Blooms can also occur in winter months, although winter dominant algal species have been found to be different from those of spring and summer. Organisms most frequently responsible for HAB outbreaks in both fresh and marine waters include cyanobacteria and dinoflagellates. In Kansas, HABs are most commonly associated with the cyanobacterial genera Microcystis, Dolichospermum (formerly in the genus Anabaena), and Aphanizomenon, with some other taxa such as Cylindrospermopsis and Oscillatoria appearing at times.

Freshwater cyanobacteria under bloom conditions are capable of producing potent toxins that can cause damage to the liver, skin and nervous system.<sup>2</sup> HABs can vary in toxicity and may pose a direct threat to human and animal health. Exposure to cyanobacterial toxins can result in adverse human health effects such as: hay fever-like symptoms, respiratory distress, skin rashes, vomiting, and diarrhea.<sup>3</sup> These toxins have also been identified as the cause of multiple animal deaths in the US.<sup>4</sup> Exposure to these toxins most commonly occurs when persons or animals come in contact with, ingest, or inhale contaminated water.<sup>3</sup> There are no known antidotes to algal toxins, so preventing exposure is imperative.

#### **SECTION 2. OVERVIEW**

This plan outlines the interaction, responsibilities, and activities of KDHE and coordination with other stakeholders, to ensure that HAB investigations are conducted in a rapid and effective manner and founded on the principles outlined below.<sup>5</sup> KDHE reserves the right to use best professional judgement in making decisions beyond or on occasion contrary to this plan and its protocols, when unusual or unpredicted circumstances occur.

- **A.** Potential HAB events will be treated as harmful until proven otherwise.
- **B.** Response to HABs will be limited to "Public Waters of the State" only. If a waterbody is not accessible to the public and does not serve as a public drinking water source, its owners/managers who request assistance with HABs will be referred to the Kansas State Veterinary Diagnostic Laboratory in Manhattan, Kansas, which has the capacity to ascertain the presence or absence of cyanobacteria in a water sample.
  - **1.** In Kansas, for the KDHE Harmful Algal Bloom response plan, "Public waters" and "Private water bodies" are defined as:
    - a. Public waters: Those waters that are referred to as reservoirs, community lakes, or state fishing lakes and/or are waters managed or owned by federal, state, county, or municipal authorities, as well as all privately owned lakes that serve as public drinking water supplies (PWS) or that are open to the public for primary or secondary contact recreation. Note: Primary contact recreation includes those activities where the body is immersed to the extent that some inadvertent ingestion of water is probable. This use shall include activities such as: boating, mussel harvesting, swimming, skin diving, waterskiing, and windsurfing. Secondary contact recreation includes any activity in which the ingestion of surface waters is not probable. These uses shall include activities such as wading, fishing, trapping, and hunting. K.A.R. 28-16-28b and 28-16-28d through 28-16-28h, Kansas Surface Water Quality Standards.
    - **b. Private water bodies**: Any freshwater reservoir or pond that is both located on and completely bordered by land under common private ownership or is not freely accessible to the public (*i.e.*, access by the public is controlled or restricted in some manner).

- c. Rivers and streams. Only classified rivers and streams that are listed in the Kansas Surface Water Register will be investigated, and these will be subject to the same criteria for eligibility as described above for lakes and ponds.
- **C.** Response should be as rapid as practicable considering the resources available.
- **D.** Response to HAB events and all advice provided will be consistent across all bureaus and responding agencies.
- **E.** KDHE will be the primary responder unless multi-agency response is requested.
- **F.** The response will include: photo documentation, toxin analysis, and, where warranted and possible, the identification and enumeration of cyanobacteria. All available information will be used to determine the public health advisories.
- **G.** Training for all responding agencies for HAB events will be conducted by KDHE to ensure the effective coordination and consistency of response amongst agencies.
- **H.** The KDHE Harmful Algal Bloom Response Plan is a dynamic document that is to be reviewed and maintained annually by KDHE.

#### SECTION 3. KDHE RESPONSIBILITY

Bureau of Water, Watershed Planning, Monitoring, and Assessment Section (BOW-WPMAS) – responsibilities shall include:

- A. Host and attend the annual Harmful Algal Bloom stakeholder meetings;
- **B.** Collect and validate incoming requests for the investigation of blue-green algae blooms to initiate sampling activities; complaints may arrive via the HAB website, HAB telephone hotline, or other forms of communication;
- C. As needed, collect incoming reports of illness related to Blue-Green Algae (BGA) from the public and forward the information to Bureau of Epidemiology and Public Health Informatics (BEPHI). BOW-WPMAS will forward all requests relating to Protected Health Information to the Epidemiology Hotline (EpiHotline);
- D. Identify sample type, location(s), and number of samples to be collected for recreational waters. For Public Water Supply lakes where associated PWS systems are not participating in the voluntary PWS monitoring program, coordinate with BOW-PWSS to obtain samples at BA or BB sites as required, as proxies for raw water intake samples;
- **E.** Analyze recreational water samples to determine the type of algae present and the level of microcystin toxins as needed. Optional analysis includes detailed identification and cell counts of BGA and other algae and analysis of other toxins;
- **F.** Coordinate other analytical needs with Kansas Health and Environmental Laboratories (KHEL), as needed;
- **G.** Review the results of water sample analyses, determining the appropriate health advisory as outlined by agency policy;
- H. Enter the results into the in-house Oracle Algae database;
- I. Host weekly (typically Thursday afternoon) meeting and telephone conference with relevant lake managers and stakeholders to review the current week's data results and to advise recommended lake status;
- J. Advise lake managers and stakeholders, when appropriate. The appropriate office for notifying stakeholders shall be determined during the initial response, depending on the waterbody and the agencies involved, and shall continue until the conclusion of the

response; see BEFS Responsibilities section for other communications. BOW-WPMAS central office shall be responsible for all communications regarding large reservoirs, public waters owned by other state and/or federal agencies, public waters with more than one stakeholder, or waterbodies that serve as sources for public water supply systems. Responsibility for communications with managers of other public waterbodies, such as county or city lakes, shall be decided on a case by case basis in collaboration with BEFS. Federal and State agencies with which KDHE will communicate may include:

- a. Kansas Department of Wildlife, Parks and Tourism (KDWPT, www.ksoutdoors.com), which is responsible for management of many recreational areas around Federal reservoirs, state fishing lakes, and other waterbodies, as well as regulation of hunting and fishing in the state:
- **b.** *U.S. Army Corps of Engineers* (USACE, <a href="www.usace.army.mil">www.usace.army.mil</a>), with district offices in Tulsa, OK and Kansas City, MO, which are responsible for management of many major reservoirs;
- **c.** *U.S.* Department of Interior, Bureau of Reclamation (USBR, www.usbr.gov); with area offices in McCook, NE and Austin, TX, which are responsible for management of seven reservoirs in Kansas.
- **d.** U.S. Environmental Protection Agency (USEPA, www.epa.gov), with Region 7 Headquarters in Lenexa, KS
- e. Kansas Department of Agriculture-Division of Animal Health (KDAH, https://agriculture.ks.gov/divisions-programs/division-of-animal-health) KDAH is the office of the state Animal Health Commissioner and may be a point of contact for the public and veterinarians regarding health effects of cyanobacteria on pets and other animals. KDAH communicates with a network of Kansas veterinarians through Flash Reports as well as through publication of a newsletter. Although HAB related animal health reporting is not mandatory in Kansas, KDAH may also report relevant animal health data back to the State Public Health Veterinarian at KDHE-BEPHI. The KDAH number is 785-564-6601.

- f. Kansas State Veterinary Diagnostic Laboratory (KSVDL, http://www.ksvdl.org/resources/news/diagnostic insights/january2018/en sley.html). KSVDL serves two very different functions: (1) They can assist private citizens with low cost fee-for-service analysis of water samples, to evaluate for the presence of cyanobacteria and/or cyanotoxins; (2) The pathologists and toxicologists perform animal necropsies and serve a support function for the state in cases of difficult animal health investigations. The phone number for KSVDL is 785-532-5650; email is clientcare@vet.k-state.edu.
- K. Communicate, via consistent messaging and public health advisory information, with lake managers, stakeholders, and users of state managed waters through various means including but not limited to:
  - a. weekly stakeholder meetings,
  - **b.** prepared signage,
  - c. website updates, and
  - d. KDHE HAB Hotline;
- L. Coordinate with the KDHE Public Information Officer (PIO) for the preparation and release of official KDHE Public Health Advisories/News Releases, as warranted;
- **M.** Provide technical assistance for water quality questions and interpretation of laboratory analytical results relative to initial and follow-up water samples, as needed;
- **N.** Assist the KDHE PIO in responding to public requests for information that require technical or scientific responses;
- O. Train KDHE and non-KDHE staff concerning sampling methods, sample submission, and chain-of-custody requirements;
- P. In collaboration with KDHE-Office of Information and Technology, review annually, the Apex Blue-Green Algae Data Management System and associated ORACLE and ESRI applications and databases;
- Q. Maintain and update content for the HAB website that is associated with and available through the KDHE public website. On this website, all information provided by the Bureau of Water (BOW), Bureau of Environmental Field Services (BEFS), and Bureau of Epidemiology and Public Health Informatics (BEPHI) (except for Protected Health

Information) shall be made available to the public. Such information shall include, but is not limited to: lists and maps of affected waterbodies, general blue-green algae information, photos of HABs, analytical results, public health notices, and warning signs for the public;

- **R.** Retain a database of photographic records and scientific data relative to water sampling, and share such data when requested;
- **S.** Maintain a database of HAB data over time for each affected body of water for future trend tracking and geospatial analysis;
- **T.** Provide technical expertise related to water quality and watershed management and technical assistance for water quality questions;
- U. Assist lake owners in identifying possible WRAPS projects, when requested; and
- **V.** Oversee and manage contractors and work with collaborators to plan effective HAB monitoring, control, and mitigation pilot projects, where resources allow.

# Bureau of Water, Public Water Supply Section (BOW-PWSS) – responsibilities shall include:

- A. Attend annual stakeholder meetings;
- **B.** Coordinate with BOW-WPMAS, where needed, to identify BA and BB ambient sample sites to serve as proxies for raw water intakes;
- **C.** Schedule with the Kansas Health & Environmental Laboratories (KHEL) to ship sample bottles, prior to May 1 of each year, to PWS systems that are participating in the voluntary Public Water Supply Harmful Algal Bloom Monitoring;
- **D.** Provide technical assistance to public water supply systems when BGA affected lakes are their main source for drinking water;
- E. In the event that finished drinking water testing indicates cyanobacterial toxins in excess of the 2015 Health Advisory levels developed by USEPA, work with the PWS and KDHE Public Information Officer (PIO) to issue an immediate Tier 1 public Advisory (24-hour notification) informing all affected customers of the situation. A public notice template will be provided by KDHE containing the appropriate health effects language and use restrictions; and

**F.** Encourage public water systems to work with KDHE, their local emergency management agency, and local health departments to develop a coordinated response to cyanotoxin detections in finished water above EPA designated health advisory levels.

# Bureau of Environmental Field Services (BEFS) and its district offices – responsibilities shall include:

- A. Attend annual stakeholder meetings;
- **B.** Provide or coordinate field staff for water sample collection and, when needed, photographic field documentation;
- C. Collect water samples or recruit qualified non-KDHE staff to do so;
- **D.** Transport samples in good condition to BOW-WPMAS, or coordinate transportation by qualified individuals, as needed;
- **E.** Maintain chain of custody from waterbody sampling to delivery of samples for analysis;
- **F.** BEFS district offices shall work with BOW-WPMAS to determine on a case by case basis who will be responsible for communications with impacted communities and managers of smaller public waterbodies, county, city, and privately owned public use lakes.
- **G.** Assist the PIO in responding to requests for information that require technical or scientific responses from agency stakeholders.

# Bureau of Epidemiology and Public Health Informatics (BEPHI) – responsibilities shall include:

- A. Attend annual stakeholder meetings;
- **B.** Maintain, as part of the KDHE Harmful Algal Bloom public website, the Human Illness Report Form and Animal Illness Report Form, which serve to collect information on HAB-related illness or death from health care providers, veterinarians, and the public;
- **C.** Answer all health-related questions through the EpiHotline;

- **D.** Complete the "Algae Bloom Reporting Form" when they receive reports of human or animal health related incidents attributed to BGA exposure, to notify BOW-WPMAS that a response needs to be initiated;
- **E.** Provide epidemiological investigation of human and animal illness related to harmful algal blooms;
- **F.** Provide technical advice on the public health aspects of HABs and coordinate the KDHE public health response;
- **G.** Analyze data and provide reports of epidemiological investigations of human and animal illness/deaths,
- **H.** Communicate, as needed, with both Federal and county/local health agencies:
  - a. In addition to compiling data at the state level, BEPHI contributes both animal health and human health HAB reports to the "One Health Harmful Algal Bloom System" (OHHABS) surveillance database, operated by US Centers for Disease Control and Prevention (CDC).
  - b. BEPHI communicates regularly with the network of County Health Departments and similar local entities and health care providers across the state; this network may be used to provide educational materials, solicit data, or issue alerts.
  - c. BEPHI reserves the option to use the Kansas Health Alert Network (KS-HAN, <a href="http://www.kdheks.gov/it\_systems/ks-han.htm">http://www.kdheks.gov/it\_systems/ks-han.htm</a>), in case of a statewide HAB-related emergency. This state emergency alert network includes county/local health departments as well as hospitals, emergency response personnel, any interested health care providers, and many more.

## KDHE Office of Communications (OC) – responsibilities shall include:

- **A.** Prepare and release the official KDHE Public Health Advisories/News Releases (See Appendix G).
- **B.** Advise BOW and BEFS when media requests for information are received that require technical or scientific responses from agency stakeholders; and

**C.** Coordinate any public forum events that may be required from time to time, (*i.e.* press conferences, public meetings), during which KDHE representatives may be required to address issues related to HABs.

#### **SECTION 4. ADVISORIES**

## 4.1 Criteria for Public Health Protection Levels

KDHE has established three levels of public health protection recommendations, "Harmful Algal Bloom (HAB) Watch," "Harmful Algal Bloom (HAB) Warning," and "Harmful Algal Bloom (HAB) Hazard." These advisory notification levels are determined by the concentration of harmful toxin level(s) and/or the concentration of cyanobacteria cell counts, as well as verified visual data; see **Table 1**. When appropriate, KDHE will recommend the following actions for:

- **A.** Harmful Algal Bloom (HAB) **Watch** serves as an advisory to notify the public that **unsafe conditions are possible** or present. A Watch is issued based on microcystin toxin concentrations, cyanobacterial cell counts, and/or visual confirmation of a bloom. Visual confirmation is determined by qualified KDHE staff working with lake managers and/or managing agencies using jar tests, photographs, and site visits. A Watch is issued if it has been analytically determined that the *microcystin toxin concentration* in the water is **greater than 4 μg/L but less than or equal to 8 μg/L<sup>6,7</sup>** and/or cyanobacterial cell counts are **greater than 80,000 cells/mL but less than or equal to 250,000 cells/mL.** Persons should use caution when in contact with lake water and avoid areas of algae accumulation.
  - 1. The appropriate HAB Watch signage (See
  - 2. Appendix B) should be posted at all primary public access locations such as beaches, marinas, boat ramps, and other main points of entry to the body of the water. If the provided signage is not used, then sign information must include:
    - a. blue-green algae are present, and the body of water may be unsafe for people and animals;
    - **b.** persons should use caution when contacting lake water and wash with clean water afterward;
    - **c.** contact information for the posting authority;

- d. the date of the posting;
- e. the symptoms of cyanobacterial exposure;
- f. what to do in case of contact with the water; and
- **g.** whom to call in case of illness potentially associated with exposure.

## The signage should also:

- **a.** discourage people from having contact with the water near visible blooms (e.g., no swimming, waterskiing);
- b. discourage allowing pets or livestock to drink or swim in the water. If animals do come in contact with the water, then they should be rinsed off with clean water immediately. They should not be allowed to lick the algae off of their fur or consume dried algae on shorelines, as algal toxins will remain toxic even in dry form;
- **c.** permit boating and fishing, although boaters should be aware of the possible inhalation of harmful spray; and
- d. indicate that if fish are caught, the fish should be properly cleaned and rinsed with clean potable water, and all internal organs removed, with only the fillets retained for human consumption;
- B. Harmful Algal Bloom (HAB) Warning serves as an advisory to notify the public that conditions are expected to be unsafe for human exposure. A warning will be issued if it has been analytically determined that the microcystin toxin concentrations are greater than 8 μg/L but less than or equal to 2,000 μg/L and/or cyanobacterial cell counts are greater than 250,000 cells/mL but less than or equal to 10,000,000 cells/mL. If there is verification of significant cyanobacterial surface scum present,<sup>7</sup> a "Warning" may be issued based on visual confirmation of significant cyanobacterial scum. It is recommended that action be taken over and above those listed in the "HAB Watch," restricting or prohibiting public exposure.
  - 1. The appropriate HAB Warning signage (See
  - 2. Appendix B) should be posted at all primary public access locations such as beaches, marinas, boat ramps, and other main points of entry to the body of water. If the provided signage is not used, then sign information must include:

- a. that blue-green algae are present and that the body of water is unsafe for people and animals;
- **b.** contact information for the posting authority;
- **c.** the symptoms of cyanobacterial exposure;
- d. what to do in case of contact with the water; and
- **e.** whom to call in case of illness potentially associated with exposure.

## The signage should also:

- **a.** restrict swimming, water skiing, boating or other activities that would involve direct contact with the affected water:
- **b.** warn that all contact with water should be avoided:
- c. warn owners not to allow pets to drink or swim in the water. If pets do come in contact with the water, then they should be rinsed off with clean water immediately. They should not be allowed to lick the algae (and toxins) off of their fur or consume dried algae on shorelines, as algal toxins will remain toxic even in dry form;
- d. warn that if fish are caught, the fish should be properly cleaned and rinsed with clean potable water, all internal organs removed, consuming only the fillets;
- C. Harmful Algal Bloom (HAB) Hazard notifies the public that extreme conditions exist. At this level, it has been analytically determined that the *microcystin toxin concentration* is greater than 2,000 μg/L and/or cyanobacterial cell count is greater than 10,000,000 cells/mL. It is recommended that either a portion of the lake, entire lake, or zone, be closed and in some cases the adjacent land (e.g., approximately 100 ft. from the shoreline) be closed to the public. Actual setback distances will be determined on a site specific basis, if necessary. If a Hazard status applies only to a somewhat isolated beach, cove or inlet, the remaining lake or zone area could be covered by a Warning. Such a distinction will be coordinated between KDHE and the lake manager.
- **D.** Zoned Lakes: Zoned lakes are impoundments considered large enough in size and with shorelines structured in such a manner that they could shelter localized algae blooms, resulting in a combination of conditions that can limit specific portions of the

lake to public use. Zoned lakes are differentiated by both size and shape and are limited to those waterbodies with a surface area over 10,000 acres and with a shoreline sinuosity index greater than 4. Only three separate lakes in Kansas meet these criteria: Milford, Perry, and Tuttle Creek Lakes. Exact zone lines were drawn based on visible landmarks for lake users. Each zone's public health protection level is based on the highest sample result collected within a zone. Zoning a lake allows for mixed health protection levels and public contact on a lake. The public should be aware that a combination of conditions can exist in the affected lake, and visitors should observe the posted notices for each specific zone. On these lakes, if a lake manager/owner issues a more stringent advisory in a zone (*i.e.*, beach closure based on Hazard level conditions), then KDHE will list the more severe advisory level.

Table 1. Waterbody Status Determination

## **Waterbody Status Determination**

## **Blue-Green Cell Count and Toxin Exposure Levels**

| Condition of Waterbody   | Advisory Level  | Recommendations  |  |  |
|--|---|--|--|--|
| Microcystin concentration ≤4 μg/L AND Cell count of ≤80,000 cells/ml   | None – Waterbody clear                                    | None   |  |  |
| Microcystin concentration  >4 μg/L to ≤8 μg/L  OR  Cell count of  >80,000 cells/ml to  ≤250,000 cells/ml  OR  Visual confirmation of bloom                             | Waterbody will be placed on a<br>Public Health<br>WATCH   | <ul> <li>» Post signage</li> <li>» Notify health dept., doctors, vets, health providers, etc.</li> <li>» Post on website</li> <li>» Notify public water suppliers</li> </ul>   |  |  |
| Microcystin concentration >8 μg/L to ≤2,000 μg/L  OR  Cell count of >250,000 cells/ml to ≤10,000,000 cells/ml  OR  Presence of significant Cyanobacterial surface scum | Waterbody will be placed on a<br>Public Health<br>WARNING | <ul> <li>» Post signage</li> <li>» <u>Restrict</u> direct contact with water</li> <li>» Notify health dept., doctors, vets, health providers, etc.</li> <li>» Post on website</li> <li>» Issue media release</li> <li>» Notify public water suppliers</li> </ul>                                     |  |  |
| Microcystin concentration >2,000 μg/L OR Cell count of >10,000,000 cells/ml  | Waterbody will be placed on a<br>Public Health<br>HAZARD  | » Recommend that portions of the lake, the entire lake, or zone, be closed. If necessary – close adjacent land up to 100 ft from shoreline.  » Post signage  » Notify health dept., doctors, vets, health providers, etc.  » Post on website  » Issue media release  » Notify public water suppliers |  |  |

#### E. Other General Health Information

- 1. If water from an affected lake is used for irrigation, then people should avoid contact with the spray, due to potential inhalation and illness. Avoid fruits and vegetables that have come into contact with contaminated water until they have been thoroughly washed with clean, potable water. Do not allow livestock to drink affected irrigation water. If water is used to irrigate pastures, livestock owners should be aware that continued application of heavily affected waters can lead to significant toxin accumulation on foliage. Although rare, this residue can affect livestock.
- 2. Areas of an affected waterbody may contain significantly higher HAB concentrations due to wind effects, increasing the health threats in localized areas.

Further information pertaining to HABs and their effects on health can be found on KDHE's HAB website at <a href="https://www.kdheks.gov/algae-illness/index.htm">www.kdheks.gov/algae-illness/index.htm</a>

## 4.2 Criteria of Status Change of Advisories

- **A.** A body of water with a HAB Watch will be sampled based on the resampling frequency discussed in **Section: 5.2 Response** Prioritization. The most recent toxin and cell count values will always determine the HAB advisory status of a lake, except if it is under Warning status due to toxin levels in a given week. In these cases, toxin levels at or below 8 ug/L must occur in two samples taken a week or more apart before a Warning can be lifted.
  - 1. Exceptions: Mixed status lakes. Lakes that have more than one "zone" will be required to follow the above described procedure for each individual zone.
  - **2.** Exceptions: If cyanobacterial cell counts are not analyzed, the decisions to lift or cancel an advisory will be based on microcystin toxin concentrations.

#### **SECTION 5. RESPONSE**

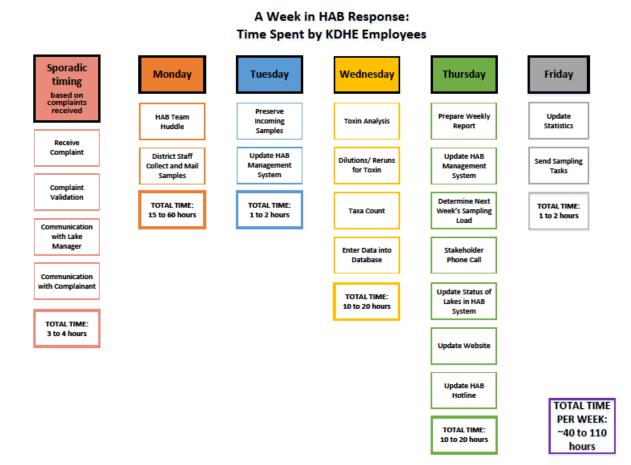
## 5.1 Harmful Algal Bloom Response Procedures

(See

## Appendix D)

A. A complaint is received concerning a potential harmful algal bloom in public waters, and an investigation is requested. Prior to any investigation, the complaint must be documented on the "Algae Bloom Reporting Form" located on the KDHE "Harmful Algal Bloom" website. BEFS/BOW will validate the existence of the bloom and location information. If a BEFS district office receives a complaint, it will collect the location information and complete the reporting form. If BEPHI receives a health-related complaint associated with a HAB, BEPHI will complete the "Algae Bloom Reporting Form."

Figure 1. HAB Response Timeline



- **B.** If a complaint is not submitted by trained federal or state staff, unless otherwise determined, then as part of the verification process, a jar test and/or photographic documentation is required (See **Appendix H** for additional information on jar testing):
  - This test must be conducted by the lake management authority/manager at a KDHE designated site(s). (If no sampling sites have been previously designated, then contact BOW-WPMAS for site locations.)
  - 2. Photos of the jar test(s) must be submitted/emailed to BOW-WPMAS for verification, along with any other photo documentation.
- **C.** BOW-WPMAS will enter the investigation request information into the KDHE HAB Management System for tracking.
- **D.** BOW-WPMAS will prioritize responses and issue sampling requests.
- **E.** BEFS District offices will collect samples and ship or transport to KDHE Central Office in Topeka, BOW-WPMAS.
- **F.** BOW-WPMAS will analyze the recreational samples collected and enter the analytical results into the BOW ORACLE Algae database, which will then migrate into the HAB Management System.
- **G.** BOW-WPMAS will review the analytical results and, if warranted, a public health recommendation will be issued consistent with KDHE's Harmful Algal Bloom Policy (See **Appendix A**).
- H. All complaint locations will be checked to determine whether the waterbody is a drinking water supply. If so, BOW-PWSS will notify the affected PWS immediately to discuss the status of the source and provide technical assistance when needed. (See BOW-PWSS Appendix F).
- I. BOW and BEFS District Offices will contact agencies, municipalities, lake owner/managers, other external stakeholders and, if applicable, the complainant, to provide them with the analysis results and the KDHE public health recommendations.
- J. Lake Managers will post the waterbody with the appropriate signage (See
- K. Appendix B).
- **L.** BOW-WPMAS will coordinate any meetings between Bureaus and between KDHE and other state and federal agencies.

- **M.** BOW will coordinate memos of recommendation for KDWPT through the Secretary's office, if needed.
- N. BOW will notify the Secretary's Office/PIO of the status for all affected waterbodies. The Office of Communications will prepare formal agency press releases and coordinate as needed with other stakeholders' Office of Communications. (See Appendix G)
- **O.** BEPHI will communicate with public health departments and animal health agencies as needed, to deliver public health advisory information.
- P. BOW-WPMAS will update the HAB Management System.
- **Q.** Based upon the HAB status, BOW will prioritize and coordinate proper follow-up testing consistent with the KDHE plan on blue-green algae response (See **Figure 1**).
- **R.** BOW will prepare information for updating of the BGA website and send it to the KDHE webmaster.
- **S.** BEPHI will conduct investigations of human and animal illness or deaths related to harmful algal blooms.
- **T.** BOW will update the HAB Management System contact list as needed.
- **U.** BEPHI will analyze data and provide reports of epidemiological investigations and human and animal illness and death.

## 5.2 Response Prioritization

The investigation timeframe and the prioritization of waterbodies shall be determined according to the following parameters, described in detail below and in **Table 2**:

- A. When there has been a human or animal health report.
- **B.** When the complaint concerns a waterbody that is an active public water supply source that is not already actively sampled through the voluntary monitoring program.
- **C.** Whether the number of complaints exceeds KDHE's capacity resources, taking into account both sample collection and laboratory analysis.
- **D.** When resampling is required.
- **E.** When the situation does not reflect the above situations.

Table 2. Priority Response Timeframe

| Lake Category  | Priority     | Response  |
|--|--------------|---|
| Lakes that Support:                                  | Priority 1   | Samples will be collected within the immediate week if the HAB  |
| Public Beach   |              | complaint form was received and verified prior to Wednesday of the  |
| Public Water Supply                                  |              | sampling week. Sampling will be conducted on the following Monday   |
| Full Body Contact Activities                         |              | otherwise.  |
|  |              | PWSS that are part of the voluntary monitoring program may have   |
| Lakes where Human or Animal                          |              | prioritization lowered as long as PWS sampling data is up to date.  |
| Illness is Suspected or Confirmed                    |              | PWSS that test above the HA at the plant intake will be sampled as  |
|  |              | promptly as possible.   |
| Dublic labor that are publish.                       | Dui a uitu 2 | Management of the state of the |
| Public lakes that are publicly                       | Priority 2   | If resources are available and sampling capacity allows, samples will be collected within the immediate week if the HAB form was received and   |
| accessible but have no swimming                      |              |   |
| beach and do not allow full body contact activities. |              | the complaint verified prior to Tuesday of the sampling week.   |
| contact activities.                                  |              | Otherwise, sampling will be conducted on the following Monday.  |
| Other public lakes that are largely                  | Priority 3   | Will respond if capacity resources are available. Otherwise, the  |
| inaccessible to the general public.                  |              | response will be handled through technical advice utilizing site  |
|  |              | photography and jar testing. KDHE may issue advisories based on   |
|  |              | visual evidence. The complainant may be advised to contact their local  |
|  |              | extension office or the Kansas State Veterinary Diagnostic Laboratory   |
|  |              | at:   |
|  |              | KSVDL Client Care   |
|  |              | 1800 Denison Ave.   |
|  |              | Manhattan, KS 66502   |
|  |              | 785-532-5650  |
|  |              | Clientcare@vet.k-state.edu  |
|  |              | 2   |

<sup>\*</sup> K.A.R. 28-16-28b - Kansas Water Quality Standards ... Public water bodies - any surface water or surface water segment that supports or, in the absence of artificial sources of pollution, would support one or more of the designated uses of surface water defined in K.A.R. 28-16-28d (b) or K.S.A. 82a-2001(c), and amendments thereto, and that meets the criteria for classification given in K.A.R. 28-16-28d (a).

<sup>\*\*</sup>K.S.A. 65-171d - (d) ... If a freshwater reservoir or farm pond is privately owned and where complete ownership of land bordering the reservoir or pond is under common private ownership, such freshwater reservoir or farm pond shall be exempt from water quality standards except as it relates to water discharge or seepage from the reservoir or pond to waters of the state, either surface or groundwater, or as it relates to the public health of persons using the reservoir or pond or waters there from.

## **A.** Health Related Reports

1. Initial Sampling. When there has been a human or animal illness reported, response will be given a high priority. If district staff are unable to provide a timely response, then staff from the Topeka office will respond to the complaint. If staff at the Topeka office cannot respond, then KDHE may request assistance from the KDWPT or USACE or another partner agency for sample collection.

## B. Public Drinking Water Source

1. *Initial Sampling*. When the waterbody is a public drinking water source and is not monitored through the PWSS voluntary monitoring program, then sampling will be initiated as promptly as possible.

## C. Does Not Exceed KDHE Capacity

1. Initial Sampling. When the number of complaints does not exceed the agency capacity, then the response will be initiated as promptly as possible. (See Figure 1 or Appendix C for a more complete timeline). To minimize the potential of exceeding staff capacity, KDHE may request assistance from KDWPT or USACE for sample collection.

## D. Exceeds KDHE Capacity

 Initial Sampling. When the number of complaints exceeds the agency capacity (to include sample collection and laboratory analysis), then response priorities will be determined by pre-set categories. (See Table 2).

### E. Resampling Frequency for Kansas Surface Water Register Waterbodies

1. During confirmed BGA blooms, the resampling frequency for affected surface waters is directly associated with the initial sampling analytical results, the waterbody's "Lake Visitation Potential," and three other potential factors. All water impoundments listed in the Kansas Surface Water Register have been ranked within either the upper 25th percentile for "visitation potential" or in the lower 75th percentile for "visitation potential" (

2.

3.

**4.** Appendix K). Visitation potential is determined using the following formula (**Figure 2**). Using this "score," BOW-WPMAS staff determine the resampling frequency for continued HAB monitoring.

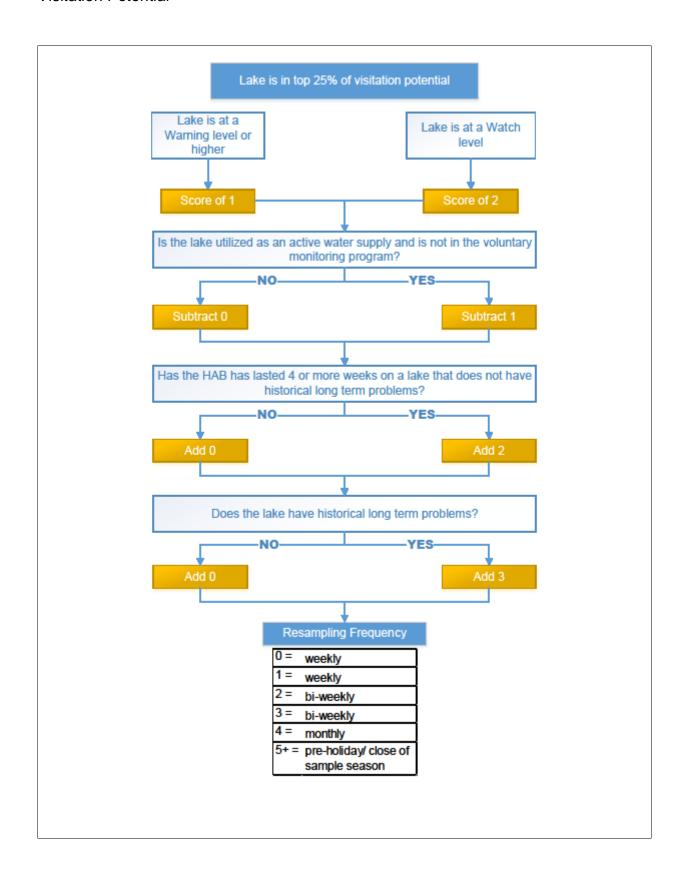
- a. Determining resampling frequency for top 25% for visitation potential,see Figure 3.
- b. Determining resampling frequency for lower 75% for visitation potential,See Figure 4.

Figure 2. Visitation Potential Formula

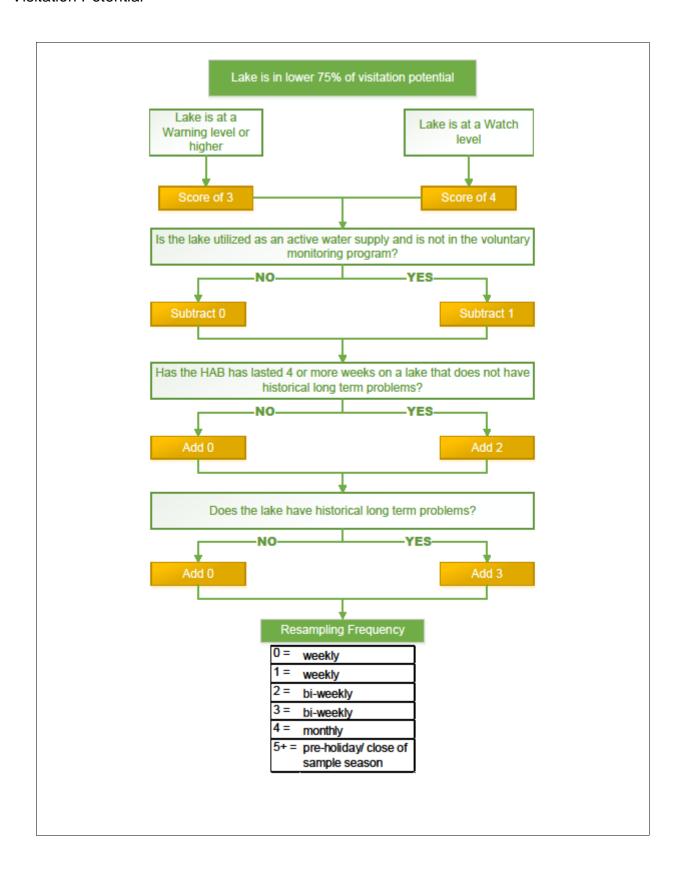
Lake Visitation Potential =

Population within 30 Miles x Lake Size Factor x Lake Density Factor x Public Access Factor x Contact Recreation Factor (**Appendix K**)

**Figure 3.** Determining Resampling Frequency for KSWR Lakes with top 25% for Visitation Potential



**Figure 4**. Determining Resampling Frequency for KSWR Lakes with Lower 75% for Visitation Potential



- F. Lakes that do not have a "visitation potential" ranking will be re-sampled monthly or at a frequency determined by the initial response priority and KDHE staff. Priority 1 Response Lakes will be given a higher priority than priority 2 or 3 responses for resampling. Priority 1 responses may be re-sampled more frequently as determined by KDHE. Priority 2 and 3 responses may be sampled less frequently as determined by KDHE.
- **G.** Sampling Deferment: KDHE may defer weekly sampling for a specific waterbody during prolonged and stable HAB events. Sampling may be deferred until visual conditions are indicative of water quality improvement.
- **H.** Any situations that occur at surface waters not defined above will be considered on a case-by-case basis.
- I. When the complaint is received for privately owned lakes (single owner shorelines or lakes with restricted access to the general public), the complainant will be advised on how they can screen their waterbody using the "Jar Test" and to contact their local extension office or the Kansas State Veterinary Diagnostic Laboratory at:

KSVDL Client Care 1800 Denison Ave. Manhattan, KS 66502 785-532-5650 www.ksvdl.org

clientcare@vet.k-state.edu

## 5.3 Sampling Season

- A. The HAB sampling season will adopt a sampling duration concurrent with the Kansas Surface Water Quality Standards Primary Contact Recreation season, from April 1 to October 31. New and continued investigations will no longer be conducted after the 31st of October, except in special circumstances. A final sample will be collected at all surface waters that are still under a HAB advisory in the last week of October to document the final analytical results and public health advisory level for the season.
- **B.** Occasionally, winter blooms of the blue-green species *Planktothrix rubescens* have been reported in Kansas outside the recreation season (appearing as surface scums of purple to red material or observed under thin ice covers). In the event a *Planktothrix rubescens* bloom is suspected, then it will be handled on a case by case basis.

C. End of Season. If lakes are still under an HAB Advisory by October 31st, then it is the responsibility of the lake's management authority to conduct observational monitoring and jar testing to assess the condition of the waterbody. BEFS/BOW staff will contact appropriate lake management to assist with the lake assessment. Until KDHE receives evidence of a negative jar test or other compelling observational data that the bloom has expired, the waterbody will remain over the winter at the status that was in effect on October 31. If the jar test or other observational data confirms the lack of a significant blue-green community, then KDHE will lift the end of the season notification.

For further questions regarding sampling of lakes and cyanobacteria, contact KDHE's Bureau of Water/Bureau of Environmental Field Services at the Harmful Algal Bloom Hotline, **785-296-1664**.

For further questions regarding health effects of cyanobacteria on humans, contact KDHE's Bureau of Epidemiology and Public Health Informatics at **877-427-7317**.

For further questions regarding health effects of cyanobacteria on pets and livestock, contact the Kansas Department of Agriculture Division of Animal Health at 785-564-6601 **during normal business hours**. If assistance is needed for an urgent issue after business hours, call the KDHE Epidemiology Hotline at **877-427-7317**.

#### **SECTION 6. SAMPLING**

## 6.1 Sampling Safety

- **A.** Field staff must exercise caution to protect themselves during HAB sampling events as cyanobacteria can produce toxins that can cause skin irritation, respiratory and/or gastric problems. When sampling from an area that has been reported to have a bloom, the following safety precautions must be followed.
- **B.** Depending on each sampling location and situation, samplers should wear at a minimum:
  - 1. Gloves, Latex or Nitrile
  - **2.** Eye protection such as safety glasses or goggles, depending on the presence of splashing or spray
  - 3. Boots or closed shoes
  - 4. Long pants
- **C.** If any of the following conditions apply, then additional Personal Protective Equipment (PPE) may be necessary.
  - 1. Conditions include:
    - **a.** If significant visual bloom or scum is present, and breezy conditions create wave action that may generate spray or aerosolize the water;
    - **b.** If there is a noticeable odor;
    - c. If prior week's samples indicate toxins are present and at levels greater than or equal to 2,000  $\mu$ g/L;
  - 2. Additional Personal Protective Equipment includes:
    - a. Elbow length gloves, Nitrile rubber
    - b. Goggles or splash guard
    - **c.** Waterproof tall boots or hip waders
    - d. For staff who are certified to wear one, half-face respirator fitted with Organic Vapor/HEPA filters. If sampler is not certified, then the DEAs/Supervisors may need to send staff who are qualified to wear

respirators or provide photographic evidence of extreme conditions. When conditions are warranted (*i.e.*, evidence of significant cyanobacterial matting), BOW-WPMAS staff may notify District Offices that personnel who are qualified to wear respirators are required to perform the sampling.

## **D.** General Sampling precautions:

- 1. Do not allow the water to come into contact with exposed skin.
- Do not touch hands to mouth, eyes, or other exposed areas of the body before washing.
- **3.** Hands should be washed thoroughly with soap and clean, fresh/potable water after sampling and before eating, drinking, or smoking.
- **4.** Remove any rings, watches or other jewelry that might have been exposed to algae contaminated water and wash skin surface area and items.
- **5.** All equipment, gloves, and waders should be rinsed with clean water (not lake water) after sampling and before storage.
- **6.** Used disposable gloves should be removed using proper technique to avoid contamination.
- 7. All wet clothing should be removed and replaced with clean, dry clothing.
- 8. Wet clothing should be washed separately before next wearing.
- **9.** Do not inhale spray from boats, wind, other water surface disturbances or irrigation water from areas with harmful algal blooms.
- **10.** Do not ingest affected water.
- **11.** Care must be taken to avoid contamination of vehicle and any common use items that may be used with bare hands (e.g., steering wheel, sample cooler, clipboards, markers).
- E. Different species of algae can produce different toxins such as neurotoxins, liver toxins, and skin irritants. It is important that field staff can recognize exposure indicators associated with algal blooms and report to their supervisors if they begin to experience potential symptoms. Symptoms can occur immediately or within days of exposure. Those symptoms can include:

- Skin irritation visible rash, hives, or blisters, especially under clothing, swimsuits, or wetsuit.
- **2.** Respiratory problems runny eyes and nose, sore throat, headache, and asthma-like symptoms.
- Kidney toxicity acute, severe gastroenteritis (including diarrhea and vomiting).
- **4.** Liver toxicity abdominal pain, diarrhea, and vomiting, may take hours or days for symptoms to appear in humans.
- **5.** Neurotoxicity numb lips, tingling fingers and toes, or dizziness, often appear within 15 to 20 minutes of exposure.
- **F.** Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, including the need to have additional PPE, or if hazardous weather conditions arise, such as lightning or high winds, then personnel should cease sampling, move to a safe place, and contact their DEA/Supervisor. Sampling can be rescheduled for a time when weather conditions have improved, or the appropriate staff with PPE are available.

## **6.2 Sample Collection/Sample Locations**

- **A.** Samples will be collected in accordance with BOW-WPMAS Standard Operating Procedures, SOP HAB-001 (Appendix J).
- B. Sampling stations for toxin or phytoplankton analysis will be selected based on common public access points, which for this particular sampling task are primarily defined as: swimming beaches, boat dock and ramps, marinas, shoreline adjacent to maintained trails and marked fishing areas, and other frequently used areas designated for public access. All sample stations will initially be determined by KDHE's Central Office. Once these stations have been identified, they will then be plotted on maps that will be provided to those conducting the sampling. If it is determined that nutrient samples are needed, they will be collected at a HAB sampling station or near BOW-WPMAS's ambient Lake Program sampling station.

- 1. If a bloom is observed at other common public access points of the lake that are not designated sampling stations, then all designated stations shall still be sampled, and an additional sample may be collected at the point where the bloom can be readily observed, and the public can readily access the water's edge.
  - a. If there is not an easy and readily available point of public access to collect this optional sample, then no additional sample is required. Under these circumstances, a determination of the status may be based on the observation of an obvious bloom and from the results of the samples collected at the designated stations. The status may be set at least at a Watch level, and the waterbody will likely be resampled the following week.
- 2. If, upon arrival, it appears that the sample collection at the designated stations is unattainable, (due, e.g., to flood waters, drought conditions/no water, impassable roads) then an alternate sample location may be determined by the sampler within proximity of the original station.
- **3.** If public waters are water sources for Public Water Supply Systems (PWS), and the PWS is not participating in the voluntary monitoring program, then:
  - **a.** When a complaint is validated, the BOW-PWSS will be notified.
  - **b.** When directed by the Public Water Supply Section, BEFS will collect initial samples at PWS proxy stations as well as "recreation" stations. If there is no established KDHE PWS sample site, then see below.
  - **c.** As needed, BOW-WPMAS will establish PWS proxy sampling stations relative to raw water intake locations:
    - 1. Samples will be collected as close to the intake as possible, or
    - Discharge samples will be collected if a PWS intake is downstream from the impacted lake/reservoir and the outflow from that lake/reservoir comprises a significant proportion of stream flow arriving at the intake of that PWS (as determined by mass balance calculations).

- KDHE has the discretion to initiate river monitoring at locations above the PWS intakes to confirm the absence/presence/concentration of microcystin toxins, if warranted.
- If levels are detectable, then KDHE-PWSS will coordinate with the affected system(s) to determine recommended resampling (See Appendix F).
- d. For PWS systems not participating in the voluntary monitoring program it will be recommended to continue to resample at PWS intake as long as the lake has elevated levels impairing recreational status (See Appendix F).
- **4.** Other types of sampling may be required to determine background levels or potential contaminant sources, or to determine whether public waters used for livestock watering are impacted.
- 5. Lakes that have multiple zones may require new sampling locations if persistent (≥ 3 days) winds drive existing blooms into unmonitored areas. During initial response activities, the zone that was subject to the response will be sampled at all established sampling stations. At a minimum, one sample from each other zones will be sampled during the initial response for microcystin toxins. During subsequent sampling activities, KDHE will determine which zones warrant testing.
- **6.** For any newly established sampling locations, a GPS point should be recorded (Datum NAD83), or the location must be marked on a map.

#### C. Miscellaneous Waterbody Sampling

## 1. Streams/Rivers

- a. Only classified rivers/streams listed in the Kansas Surface Water Register will be investigated.
- **b.** Initial sampling will typically be conducted by BEFS District Office staff or by BOW-WPMAS Central Office staff, depending upon location and resources available.

- If analysis for toxins are above detection, then BOW-PWSS will notify all Public Water Supply (PWS) systems downstream, and it will be the responsibility of the systems to continue resampling. (See PWS Appendix F), or
- If analysis indicates that toxin and/or cell count levels are above recreation levels, then resampling and notification will be at the discretion of the agency for livestock watering, irrigation, and recreation uses.
- 2. Sampling and resampling of other miscellaneous public use waterbodies will be conducted at the discretion of KDHE.

## 6.3 Sample Types/Sample Analysis

There may be three types of samples collected for HAB events: toxin samples, phytoplankton samples, and nutrient samples. Samples will be collected in accordance with BOW-WPMAS HAB-001 and HAB-002 (Appendix J), and analysis will be in accordance with BOW-WPMAS HAB-003 (Appendix J).

### **A.** Toxin samples:

- 1. Toxin samples will always be analyzed for levels of microcystin toxins, using the ELISA Qualitube Kit (EnviroLogix, Portland, ME) or functional equivalent.
- 2. When cyanobacteria that produce cylindrospermopsin toxin have been identified, then the level of toxin may be determined using Abraxis (Abraxis, Inc, Westminster, PA) test strips or functional equivalent (optional).
- **B.** Phytoplankton samples: Depending on the staff and resources available, phytoplankton samples may be analyzed for:
  - 1. Taxon identification, with blue-greens typically to genus;
  - 2. Cell counts and blue-green cell percentage;
    - a. If the analytical lab is at capacity for sample processing, then, for lakes that have more than one station, KDHE has the discretion to determine which sample will have taxonomy and cell counts performed. Typically, the sample with the worst (most green) visual appearance will take

priority. If there is no discernible difference between the worst sample(s), then KDHE will select the sample that is most likely to have a negative impact on health, based on data available. Data informing this decision could include the importance of the sampling stations for human health, wind conditions during sampling, reporting from the field, photographic evidence, jar test results, or previous analysis results (Appendix I).

- **b.** Those samples not analyzed during the response week should be retained for the duration of the HAB season, at which time KDHE may determine to perform additional analyses or dispose of the sample(s).
- **3.** Cell biovolume (at the discretion of analyst).
- **C.** Nutrient samples **may** be analyzed for:
  - 1. Nitrate;
  - 2. Nitrite:
  - 3. Kjeldahl nitrogen;
  - 4. Ammonia;
  - 5. Total phosphorus; and
  - **6.** Ortho-phosphate;
- **D.** Additional field and laboratory measurements and analytes may include:
  - 1. Water Temperature (field);
  - 2. Air Temperature (field);
  - 3. pH (field or lab);
  - 4. Dissolved oxygen (field or lab);
  - 5. Chlorophyll-a; and
  - Liquid Chromatography Mass Spectrometry (LCMS) analyses for microcystin variants and other algal toxins.

Sample analysis will be conducted in accordance with BOW-WPMAS SOP HAB-003 (See Appendix J). Additional analyses may be required and will be based on individual investigation circumstances.

### **SECTION 7: ANNUAL PROGRAM MANAGEMENT**

The HAB program is busiest during the April to October contact recreation season but has multiple tasks during the off season. The following is a general annual timeline of events, beginning with the first day of the active season.

## April

- All involved staff are informed of any new changes to the KDHE Agency HAB Response Plan as well as any changes to the computer interface side of the HAB program.
- If no changes have taken place, the staff is still informed/refreshed with current protocols.
- Stakeholders are sent standing invitations to the weekly HAB Meeting and Conference Call.
- Once the first complaint comes in, the weekly work cycle is followed, as documented in **Appendix C**. This continues throughout the season.

## September

 The process of compiling subjects and inviting speakers and exhibitors for the annual meeting begins, along with identification of possible venues and dates.

### October

- All lakes left with advisories will be sampled to determine their season closure status.
- In this final month of HAB season, during the conference call and in the stakeholder weekly email, KDHE solicits suggestions for changes to the HAB Response Plan.

### November

- The BOW-WPMAS response team works with KDHE Office of Information and Technology staff for any modifications to the software or databases that support the HAB response program.
- At the end of November, the team begins contacting lake managers with the object of closing out as many outstanding advisories as possible.

- The speakers and agenda for the annual meeting are set, and the date and location are finalized.
- Identify and begin completion of all other tasks and arrangements required for the annual meeting. This includes the initiation of any necessary contracts, mechanisms for participant registration, and the like.

### December

 At the end of the month, call and close out as many outstanding advisories as possible, then, at the end of the month, close out in the HAB system any existing lakes on advisories.

## January

- Re-submit any lakes that were not lifted in the previous year into HAB
   Management System. The closeout and re-submission is done so that the
   system can generate annual statistics and to track extended HAB problems.
- Complete all final arrangements and tasks for the annual meeting, including:
   agendas; name tags; acquisition of equipment, printing of materials, etc.
- The annual meeting is held.

## February

- A hot wash of the annual meeting takes place to document improvement for the next annual meeting.
- A conference room for Thursday afternoons from April 1 through the Thursday after the last Monday in October is reserved.
- All revisions proposed for the response plan are discussed and those deemed necessary are added to the plan.
- March The Response Plan is published for the season ahead

## **SECTION 8. DATA MANAGEMENT**

Waterbody data, analysis data, advisory status, and tasks are managed through the HAB Data Management System, which includes three components.

- A. The Survey Web Application takes complaints from the public and/or lake managers for possible harmful algal blooms and Human and/or Animal Illness complaints (Appendix L, DM-001). This front end is built in ESRI Survey123.
- B. The HAB Tracker, which is built in Apex software environment, manages complaints, field assignments, evaluates the final analytical results, and calculates the health protection level recommendations. In addition, this program has a web presence which shows locations, recommendations and the ability to produce data reports (Appendix L, DM-003.)
- C. ORACLE and GIS databases. The data support for the "Harmful Algae Bloom" system consists of two parts: 1) the "Site ID" geospatial database; and 2) the ORACLE ENVI Algae Database (Appendix L, DM-002.)
  - 1. Site ID geospatial database contains waterbody map coverages as well as a map of existing sampling stations. New sampling stations can also be added through this application. This system is linked to the HAB Tracker and provides all geospatial data for it.
  - 2. Algae Database contains taxonomy, cell counts, and results of toxin analyses performed at the KDHE central office. This system is linked to the HAB Management System and is required to be completed to provide the HAB Management System with the data needed to evaluate and generate a health protection level recommendation.

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## **APPENDIX A**

KDHE Policy: Guidelines for Addressing Harmful Algal Blooms in Kansas

Recreational Waters



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April 1, 2020

### KDHE INTERNAL DIRECTIVE 2020 - HAB

Subject: Policy: Guidelines for Addressing Harmful Algal Blooms in Kansas Recreational Waters

### 1. PURPOSE.

The KDHE mission is to protect and improve the health and environment of all Kansans. This policy considers the health and environmental risks of Harmful Algal Blooms (HABs) in recreational waterbodies, as well as the economic impact on resources within our agency. As HABs are both pervasive and relatively unpredictable, this issue presents unique challenges in health risk assessment. The basis for this policy is the epidemiologic and scientific study of HAB data collected by KDHE in Kansas as well as the analysis of established scientific and medical research, including studies conducted by the US Environmental Protection Agency (USEPA) and the World Health Organization (WHO).

### 2. BACKGROUND.

Cyanobacteria, also known as blue-green algae, can produce toxins in recreational waters and have been implicated in human and animal illness in Kansas. The threat to health is related to the prevalence of cyanotoxins and cyanobacterial cell concentrations in recreational water and corresponding contact with or ingestion of the cyanobacterial cells or cyanotoxins. Exposure may occur via contact, ingestion, or inhalation and may be from affected water, spray, aerosols, or dried algae. There are no known antidotes for cyanotoxins.

During a HAB, children are at a greater risk than adults, due to their lower body weight. In addition, behavior of children when exploring recreational water may create more opportunities for exposure than adults; they typically swallow a higher volume of water, exposing them to a higher volume of toxin. Individuals with compromised immune systems, liver disease, kidney damage, and women who are pregnant or nursing may also be more vulnerable to HABs than the general population. The most common complaints after recreational exposure to cyanobacteria and associated toxins include vomiting, diarrhea, skin rashes, eye irritation, and respiratory symptoms. As the concentration of cyanobacterial cells increases, the probability of adverse health effects also increases.

Science on cyanobacteria and their associated toxins is rapidly advancing, and the USEPA has recently (2019) set recommended ambient water quality criteria for cyanotoxins in recreational water, for microcystin at no greater than 8  $\mu$ g/L and cylindrospermopsin at no greater than 15  $\mu$ g/L. Microcystin is the cyanotoxin most commonly found in Kansas waterbodies. Microcystin toxin is the foundation of this policy but KDHE retains the right to develop supplemental policy should other cyanotoxins become prevalent and problematic at Kansas waterbodies.

### 3. PROCEDURES.

Once a credible HAB compliant has been submitted for a public waterbody, KDHE samples the waterbody for cyanobacteria. Samples are taken at established public access points, such as swim beaches, fishing piers, and boat ramps. KDHE has the capability to test for microcystin toxin and to identify and quantify the type of cyanobacteria present. The issuing of a public health advisory is based on the concentration of microcystin toxin, cyanobacterial cell density, or verified visual evidence.

When a HAB has been confirmed in a Kansas public lake, KDHE will issue a Public Health Watch, Warning, or Hazard advisory, depending on the level of risk associated with the HAB, as determined through water sampling or visual confirmation. Under emergency conditions, when staff and analytical resources are severely limited, visual confirmation of possible HABs can be the primary means of determining that a Public Health Warning is to be issued for a given lake. While conservative, this contingency approach alerts the public to possible issues at a recreation lake without delay.

### 4. ACTION.

The primary distinctions among a Public Health Watch, a Public Health Warning, and a Public Health Hazard are:

- a. the level of risk that needs to be communicated to the public; and
- b. the actions recommended to the governing authority of the affected waterbody, to discourage exposure.

Implementation of appropriate measures to restrict exposure will be the responsibility of the governing authority of the affected waterbody. If the governing authority chooses to post or close the waterbody, KDHE can provide examples of Watch, Warning, and Hazard signs, as well as informational signs.

A <u>Public Health Watch</u> serves as an advisory to notify the public that hazardous conditions are possible or present. A Watch will be issued when the microcystin toxin concentration is detectable at a concentration above 4 µg/L and/or when cyanobacterial cell counts are above 80,000 cells/mL.

The following guidance is provided for a Public Health Watch:

- KDHE will post Public Health Watch advisories on its website and issue a press release.
- KDHE will notify any public water suppliers with intakes in the affected waterbody or downstream of the waterbody will be notified.
- Signs should be posted at beaches, marinas, boat ramps, and other points of public access to the waterbody.
- Local Health departments, physicians, veterinarians, and hospitals are advised to report adverse health
  events associated with HAB exposure or cyanobacterial toxin poisoning to the KDHE Bureau of
  Epidemiology and Public Health Informatics.
- Members of the public should be advised of the symptoms of cyanobacterial poisoning, what to do in case
  of exposure to a cyanobacteria bloom, and whom to call in case of illness potentially associated with
  exposure.
- Members of the public should be advised of the following:
  - o Harmful algae may be present, and the waterbody may be unsafe for people and animals.
  - o Swimming, wading, and jet skiing are discouraged near visible blooms.
  - Boating and fishing are acceptable, provided that contact with the water is minimized, and any exposure to contaminated water is followed by washing with clean water.

- Pets and livestock should not be allowed to drink the water, swim in it, or touch or eat dried algae on the shoreline.
- Fish caught during a Public Health Watch should first be cleaned and the entrails discarded, and only the fillet portion should be eaten.
- Irrigation water affected by a HAB could pose a risk; avoid the spray and thoroughly wash fruits or vegetables in clean water.

A <u>Public Health Warning</u> supersedes a Watch and serves as an advisory to notify the public that conditions are expected to be unsafe for human and animal exposure. A Warning will be issued when microcystin toxin concentrations are greater than 8  $\mu$ g/L and/or when cyanobacterial counts are greater than 250,000 cells/mL. A Warning may also be issued if there is verified documentation of a visible, pervasive cyanobacterial scum present, particularly when emergency conditions limit the availability of staff and resources to conduct a quantitative analysis.

The following recommendations are provided for a Public Health Warning:

- KDHE will post Public Health Warning advisories on its website and issue a press release.
- KDHE will notify any public water suppliers with intakes in the affected waterbody or downstream of the waterbody.
- Signs should be posted at beaches, marinas, boat ramps, and other points of public access to the waterbody.
- Local Health departments, physicians, veterinarians, and hospitals are advised to report adverse health
  events associated with HAB exposure or cyanobacterial toxin poisoning to the KDHE Bureau of
  Epidemiology and Public Health Informatics.
- Members of the public should be advised of the symptoms of cyanobacterial poisoning, what to do in case
  of exposure to a cyanobacteria bloom, and whom to call in case of illness potentially associated with
  exposure.
- Members of the public should be advised of the following:
  - o Harmful algae are present at a level considered unsafe for people and animals.
  - Any contact with water is considered a high risk and should be restricted, including swimming, wading, boating, water skiing, or jet skiing.
  - Pets and livestock should not be allowed to drink the water, swim in it, or touch dried algae on the shoreline.
  - Fish caught during a Public Health Warning should first be cleaned and the entrails discarded, and only the fillet portion should be eaten.
  - Irrigation water affected by a HAB could pose a risk; avoid the spray and thoroughly wash fruits or vegetables in clean water.

A <u>Public Health Hazard</u> supersedes a Warning and serves as an advisory to notify the public that extreme conditions exist. A Hazard will be issued when microcystin toxin concentrations exceed 2,000  $\mu$ g/L and/or cyanobacteria cell counts are greater than 10,000,000 cells/mL.

The following recommendations are provided for a Public Health Hazard:

- KDHE will post Public Health Hazard advisories on its website and issue a press release.
- KDHE will notify any public water suppliers with intakes in the affected waterbody or downstream of the waterbody.

- Local Health departments, physicians, veterinarians, and hospitals are advised to report adverse health
  events associated with cyanobacteria toxin poisoning to the KDHE Bureau of Epidemiology and Public
  Health Informatics.
- It is recommended that all in-lake recreation cease.
- In many cases, it is also recommended that picnic, camping and other public land activities directly
  adjacent to affected waters be closed.

### 5. FOLLOW UP SAMPLING.

A waterbody with any type of active HAB advisory, whether Watch, Warning, or Hazard, will be tested by KDHE on a regular basis and in a consistent manner, provided adequate staffing and analytical resources are available.

A Public Health Watch will remain in effect until the cyanobacterial concentrations are 80,000 cells/mL or lower at all sample sites and microcystin toxin concentrations are  $4 \mu g/L$  or lower at all sample sites, at which point the Watch will be lifted.

A Public Health Warning based on cell counts will remain in effect until the cyanobacterial concentrations are 250,000 cells/mL or lower at all sample sites for at least one week. A Public Health Warning based on microcystin toxin concentrations will remain in effect until microcystin toxin concentrations are 8 μg/L or lower at all sample sites for a given week and for the next consecutive sample, taken the following week or later. Waterbodies meeting these criteria may have the Warning lifted or may be reduced to a Watch level, depending on results. Any Warning advisory that was issued based on visual evidence alone will remain in effect until the bloom dissipates and either: (a) toxin analysis confirms the absence of health risk or, (b) the recreation season ends.

A Public Health Hazard will remain in effect until the cyanobacterial concentrations are 10,000,000 cells/mL or lower and concentrations of microcystin toxin concentrations are 2000 ug/l or lower at all sample sites for at least one week. Waterbodies meeting these criteria may have the Hazard lifted or may be reduced to a Warning or Watch level, depending on results.

Leo Henning

Deputy Secretary and Director of Environment Kansas Department of Health and Environment )ata

**APPENDIX B** 

**Notification Signs** 

## WATCH

## Harmful Algae Possible and May be Present

Blue-Green Algae May be Harmful to Humans & Animals



Swimming, wading, and jet skiing are discouraged near visible blooms.



away from water.

- Use caution when contacting lake water and wash with clean water afterward
- Avoid areas of algae accumulation
- Do not let people or pets eat dried algae or drink untreated water
- Clean fish well and discard guts

In case of contact with harmful algae: Call a doctor or veterinarian if people or animals have nausea, vomiting, diarrhea, rash, irritated eyes, seizures, breathing problems or other unexplained illness.

## Report harmful algal blooms to

Kansas Department of Health and Environment at: www.kdheks.gov/algae-illness/

Or call: 785-296-1664

### Report possible algal bloom related illness to Kansas Department of Health and

Environment at: www.kdheks.gov/algae-illness

Or call: 877-427-7317



For more information: Scan this code or visit kdheks.gov/algae-illness

Posted by:

Posted on:

## WATCH

## Harmful Algae Possible and May be Present

Blue-Green Algae May be Harmful to Humans & Animals



Keep pets & livestock away from water.

- Use caution when contacting lake water and wash with clean water afterward
- Avoid areas of algae accumulation
- Do not let people or pets eat dried algae or drink untreated water
- Clean fish well and discard guts

In case of contact with harmful algae: Call a doctor or veterinarian if people or animals have nausea, vomiting, diarrhea, rash, irritated eyes, seizures, breathing problems or other unexplained illness.

### Report harmful algal blooms to

Kansas Department of Health and Environment at: www.kdheks.gov/algae-illness/

Or call: 785-296-1664

## Report possible algal bloom related illness to Kansas

Department of Health and Environment at: www.kdheks.gov/algae-illness

Or call: 877-427-7317

For more information: Scan this code or visit kdheks.gov/algae-illness

Posted by:

Posted on:

## **ADVERTENCIA**

## Presencia de algas nocivas

Las algas azul-verdosas pueden ser dañinas para los seres humanos y los animales



Mantenga las mascotas y ganado lejos del agua

- Tenga cuidado al ponerse en contacto con el agua del lago y lávese con agua limpia después
- Evite las zonas de acumulación de algas
- No permita que otras personas o animales coman algas secas o beban agua no tratada del lago
- · Limpie bien el pescado y deseche las entrañas

En caso de contacto con algas nocivas: consulte un médico o veterinario si personas o animales tienen náuseas, vómitos, diarrea, erupción cutánea, irritación de ojos, convulsiones, problemas respiratorios u otras enfermedades inexplicadas

Reporte floraciones de algas al

Departamento de Salud y Medio Ambiente de Kansas: www.kdheks.gov/algae-illness O llame al: 785-296-1664 Reporte posibles enfermedades causadas por la floración de algas al

Departamento de Salud y Medio Ambiente de Kansas: www.kdheks.gov/algae-illness O llame al: 877-427-7317



P ara obtener más información: Escanee este código o visite kdhe.ks.gov/ algae-illness

Publicado por:

. . .

Publicado en:

## WARNING

## **Harmful Algae Expected or Present**

People & Animals May Get Sick



No water contact, swimming, or wading



No skiing or jet skis



No pets or livestock

- If people or pets contact lake water: wash with clean, potable water afterward
- Avoid areas of algae accumulation
- Do not let people or pets eat dried algae or drink untreated water
- Clean fish well and discard guts

In case of contact with harmful algae: Call doctor or veterinarian if people or animals have nausea, vomiting, diarrhea, rash, irritated eyes, seizures, breathing problems or other unexplained illness.

## Report harmful algal blooms to

Kansas Department of Health and Environment at: www.kdheks.gov/algae-illness/

Or call: 785-296-1664

## Report possible algal bloom related illness to Kansas Department of Health and

Environment at: www.kdheks.gov/algae-illness

Or call: 877-427-7317



For more information: Scan this code or visit kdheks.gov/algae-illness

Posted by:

Posted on:

## ADVERTENCIA

## Presencia de algas nocivas

Se pueden enfermar personas y animales







Evite el esquí acuático o el iet ski



Mantenga las mascotas y ganado lejos del agua

- Si la gente o las mascotas se mojan con el agua del lago lave con agua limpia tan pronto como sea posible
- Evite las zonas de acumulación de algas
- No permita que otras personas o animales coman algas secas beban agua no tratada del lago
- Limpie bien el pescado y deseche las entrañas

En caso de contacto con algas nocivas: consulte un médico o veterinario si personas o animales tienen náuseas, vómitos, diarrea, erupción cutánea, irritación de ojos, convulsiones, problemas respiratorios u otras enfermedades inexplicadas

### Reporte floraciones de algas al Departamento de Salud y Medio Ambiente de Kansas: www.kdheks.gov/algae-illness

O llame al: 785-296-1664

## Reporte posibles enfermedades causadas por la floración de algas al

Departamento de Salud y Medio Ambiente de Kansas: www.kdheks.gov/algae-illness O llame al: 877-427-7317



P ara obtener más información: Escanee este código o visite kdhe.ks.gov/ algae-illness

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## DANGER

## **BEACH CLOSED**

**Harmful Algae Present** 

People & Animals May Get Sick



# STAY OFF OF BEACH

In case of contact with harmful algae: Call doctor or veterinarian if people or animals have nausea, vomiting, diarrhea, rash, irritated eyes, seizures, breathing problems or other unexplained illness.

Report harmful algal blooms to

Kansas Department of Health and Environment at: www.kdheks.gov/algae-illness/

Or call: 785-296-1664

Report possible algal bloom related illness to Kansas

Department of Health and Environment at: www.kdheks.gov/algae-illness

Or call: 877-427-7317



For more information: Scan this code or visit kdheks.gov/algae-illness

Posted by:

Posted on:

Kansas Department of Health and Environment, 1000 SW Jackson, Topeka, Kansas 66612, 785-296-1500 www.kdheks.gov

Example of "Beach Closed" signage for use during Public Health Hazard advisory

## PELIGRO

## **PLAYA CERRADA**

Presencia de algas nocivas

Se pueden enfermar personas y animales



## NO SE ACERQUE A LA PLAYA

En caso de contacto con algas nocivas: consulte un médico o veterinario si personas o animales tienen náuseas, vómitos, diarrea, erupción cutánea, irritación de ojos, convulsiones, problemas respiratorios u otras enfermedades inexplicadas

Reporte floraciones de algas al Departamento de Salud y Medio Ambiente de Kansas: www.kdheks.gov/algae-illness 0

www.kdheks.gov/algae-illness 0 Ilame al: 785-296-1664 Reporte posibles enfermedades causadas por la floración de algas al

Departamento de Salud y Medio Ambiente de Kansas: www.kdheks.gov/algae-illness O llame al: 877-427-7317



P ara obtener más información: Escanee este código o visite kdhe.ks.gov/ algae-illness

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## DANGER

## **LAKE CLOSED**

**Harmful Algae Present** 

People & Animals May Get Sick



## KEEP OUT OF LAKE

In case of contact with harmful algae: Call doctor or veterinarian if people or animals have nausea, vomiting, diarrhea, rash, irritated eyes, seizures, breathing problems or other unexplained illness.

## **Report harmful algal blooms** to Kansas Department of Health and

Environment at: www.kdheks.gov/algae-illness/

Or call: 785-296-1664

Report possible algal bloom related illness to Kansas

Department of Health and Environment at: www.kdheks.gov/algae-illness

Or call: 877-427-7317



For more information: Scan this code or visit kdheks.gov/algae-illness

Posted by:

Posted on:

Kansas Department of Health and Environment, 1000 SW Jackson, Topeka, Kansas 66612, 785-296-1500 www.kdheks.gov

Example of "Lake Closed" signage for use during Public Health Hazard advisory

## PELIGRO

## **LAGO CERRADO**

Presencia de algas nocivas

Se pueden enfermar personas y animales



## NO SE ACERQUE A EL LAGO

En caso de contacto con algas nocivas: consulte un médico o veterinario si personas o animales tienen náuseas, vómitos, diarrea, erupción cutánea, irritación de ojos, convulsiones, problemas respiratorios u otras enfermedades inexplicadas

Reporte floraciones de algas al Departamento de Salud y Medio Ambiente de Kansas:

www.kdheks.gov/algae-illness 0 llame al: 785-296-1664 Reporte posibles enfermedades causadas por la floración de algas al

Departamento de Salud y Medio Ambiente de Kansas: www.kdheks.gov/algae-illness O llame al: 877-427-7317



P ara obtener más información: Escanee este código o visite kdhe.ks.gov/ algae-illness

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| Dublicado |  |

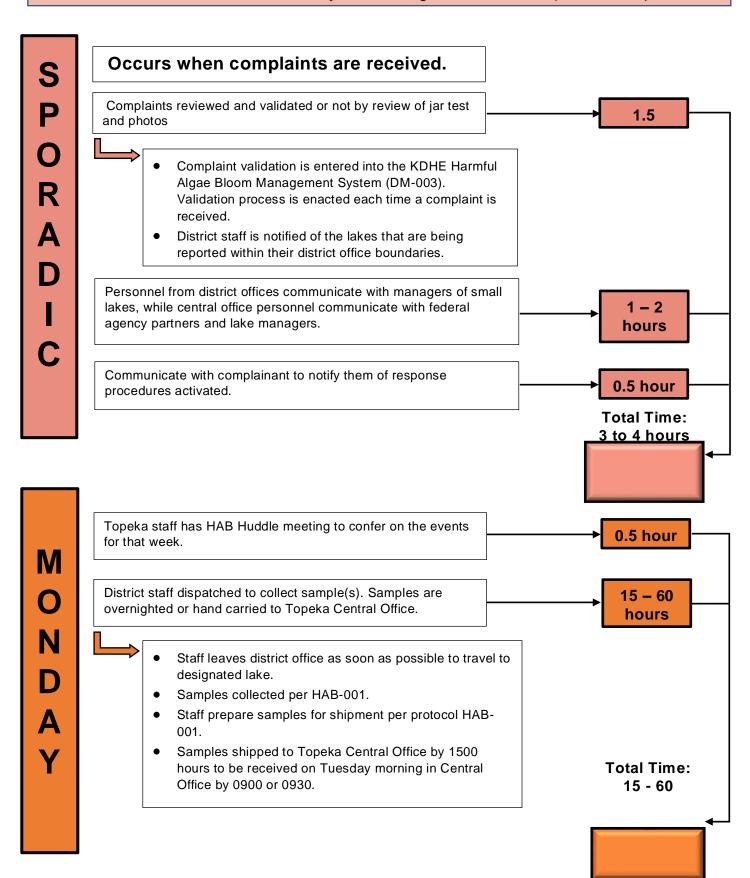
Publicado en

## APPENDIX C

A Week in a HAB Response

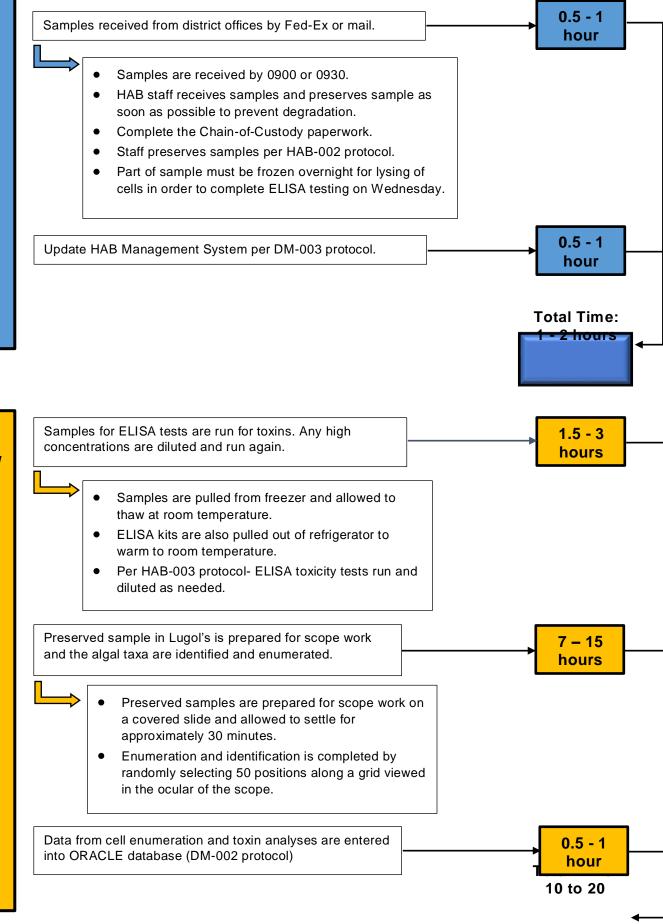
## A WEEK IN HAB RESPONSE

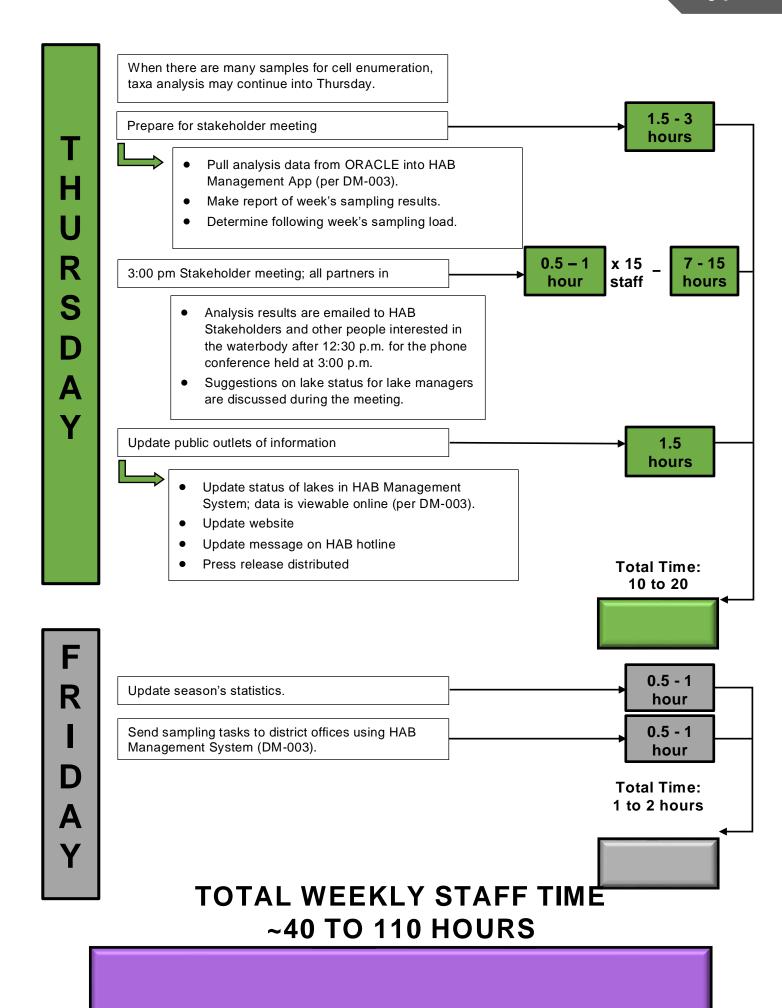
Accounting of KDHE staff time spent on HAB response based on a moderate to busy week during the HAB season (7 – 15 lakes)



# TUESDAY

S





## **APPENDIX D**

KDHE's Harmful Algal Bloom Response Procedures Flow Chart

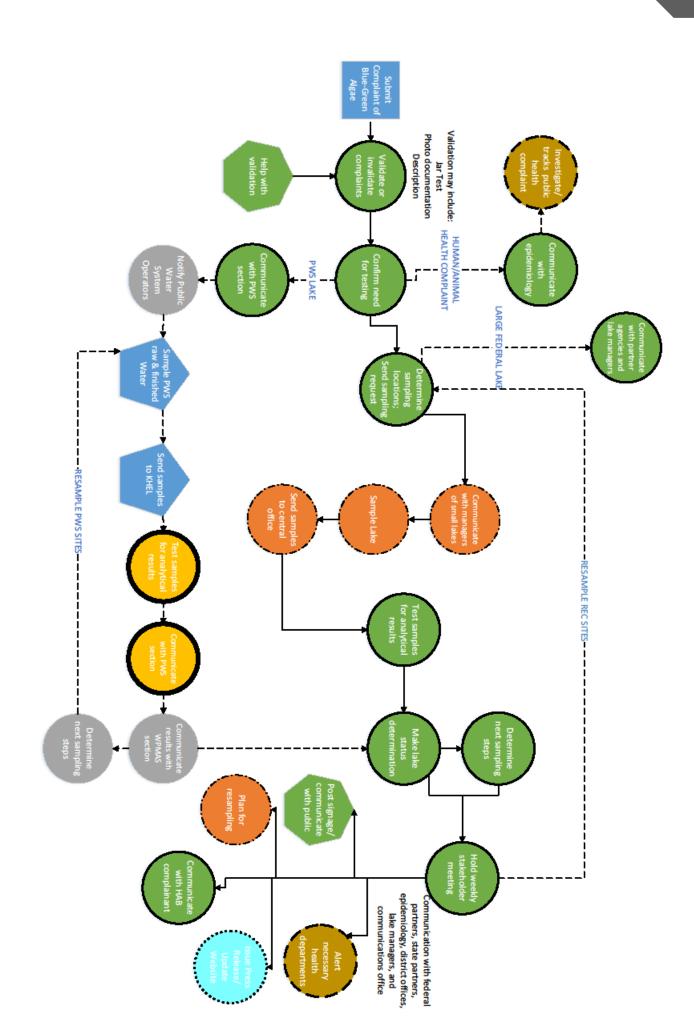
## KEY











## **APPENDIX E**

Algae Submission Form/ Chain of Custody

| Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  Traw" or "finished" can be put in the appropriate field)  Ddor:  Earthy/Musty Taste: Sour/Acidic Chlorinous Salty Grassy/Woody Bitter Marshy/Septic Fragrant/Flowery Fishy/Aquarium Medicinal Medicinal Hydrocarbon/Chemical When the finished or raw water.  Sour/Acidic Sour/Acidic Survey Survey Mouthfeel Sweet Fragrant/Flowery Mouthfeel Tovers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.   | If multiple sites are sampled for algae, submit more than one cubetainer.  If submitting aquatic plants, use a ziplock bag with only a tiny amount of water in the bag.  Ship them ASAP using only a small amount of ice (too cold can damage some species).  Check which type(s) of problem are being investigated:  Blue-Green Bloom  Taste/Odor Incident  Aesthetic Complaint  Livestock/Pet Kill  Check type of waterbody Samples collected from:  Lake/Pond  Stream/River  Other (briefly describe in space to left)  Check type of waterbody samples collected from:  Lake/Pond  Stream/River  Other (briefly describe in space to left)  Fithis is a taste/odor incident, please provide any additional data related to the treatment plant, weather, etc.  Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  Traw" or "finished" can be put in the appropriate field)  Odor:  Earthy/Musty  Taste:  Sour/Acidic  Chlorinous  Grassy/Woody  Bitter  Fragrant/Flowery  Marshy/Septic  Fragrant/Flowery  Fishy/Aquarium  Medicinal  Hydrocarbon/Chemical  Fithis is not a taste/odor incident (i.e., fishkill, bloom, etc.), please indicate any other data or information related to the incident including field conditions, other chemical data, current and preceding weather, etc.). If chemical data are sent to KHEL, please  | Send this form                         | with samples to:  | Kansas Department   | n, Monitoring, and Assessment Section<br>of Health and Environment<br>twe., Suite 420 (Curtis State Office Building)<br>312-1367   |      |
|--|--|--|---|---|--|------|
| Blue-Green Bloom Taste/Odor Incident Aesthetic Complaint Livestock/Pet Kill Check type of waterbody samples collected from: Lake/Pond Stream/River Other (briefly describe in space to left)  Check type of waterbody samples collected from: Lake/Pond Stream/River Other (briefly describe in space to left)  Other (briefly describe in space to left)  Taste: Sour/Acidic Chlorinous Grassy/Woody Grassy/Woody Grassy/Woody Grassy/Woody Grassy/Woody Fishy/Aquarium Medicinal Hydrocarbon/Chemical  Blue-Green Bloom Taste/Odor Incident Aesthetic Complaint Livestock/Pet Kill | Blue-Green Bloom Taste/Odor Incident Aesthetic Complaint Livestock/Pet Kill Check type of waterbody samples collected from: Lake/Pond Stream/River Collector, Date, Time  Check type of waterbody samples collected from: Lake/Pond Stream/River Other (briefly describe in space to left)  Check type of waterbody samples collected from: Lake/Pond Stream/River Other (briefly describe in space to left)  Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  Traw" or "finished" can be put in the appropriate field)  Ddor: Earthy/Musty Taste: Sour/Acidic Chlorinous Grassy/Woody Grassy/Woody Marshy/Septic Fragrant/Flowery Fishy/Aquarium Medicinal Medicinal Medicinal Medicinal Medicinal Mydrocarbon/Chemical  fthis is not a taste/odor incident (i.e., fishkill, bloom, etc.), please indicate any other data or information related to the incident including field conditions, other chemical data, current and preceding weather, etc.). If chemical data are sent to KHEL, please   | lf m<br>lf s                           | nultiple sites are sampled f<br>ubmitting aquatic plants, u   | or algae, submit more the<br>se a ziplock bag with only     | an one cubetainer.<br>y a tiny amount of water in the bag.   |      |
| Livestock/Pet Kill  Livestock/Pet Kill  Check type of waterbody samples collected from:  Lake/Pond Stream/River  Other (briefly describe in space to left)  Check type of waterbody samples collected from:  Lake/Pond Stream/River  Other (briefly describe in space to left)  Fithis is a taste/odor incident, please provide any additional data related to the treatment plant, weather, etc.  Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  Traw" or "finished" can be put in the appropriate field)  Odor:  Earthy/Musty Taste:  Sour/Acidic Chlorinous Salty Grassy/Woody Bitter Marshy/Septic Sweet Fragrant/Flowery Fragrant/Flowery Frishy/Aquarium Medicinal Hydrocarbon/Chemical  "Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.  | Livestock/Pet Kill  Check type of waterbody samples collected from:  Lake/Pond  Stream/River  Collector, Date, Time  Collector, Date, Tim |  |   | Check w   | Blue-Green Bloom<br>Taste/Odor Incident  |      |
| Collector, Date, Time  Lake/Pond Stream/River Other (briefly describe in space to left)  Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  ("raw" or "finished" can be put in the appropriate field)  Odor:  Earthy/Musty Chlorinous Chlorinous Grassy/Woody Bitter Marshy/Septic Fragrant/Flowery Fishy/Aquarium Medicinal Medicinal Medicinal Medicate the type of mouthfeel to the right.  | Lake/Pond StreamRiver Other (briefly describe in space to left)  Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  ("raw" or "finished" can be put in the appropriate field)  Odor:  Earthy/Musty Taste: Sour/Acidic Chlorinous Salty Grassy/Woody Bitter Marshy/Septic Sweet Fragrant/Flowery Fishy/Aquarium Medicinal Medicinal Hydrocarbon/Chemical  If this is not a taste/odor incident (i.e., fishkill, bloom, etc.), please indicate any other data or information related to the incident (including field conditions, other chemical data, current and preceding weather, etc.). If chemical data are sent to KHEL, please   | Include LM Nu                          | mber and Suffix   |   | Livestock/Pet Kill   |      |
| Collector, Date, Time  Other (briefly describe in space to left)  If this is a taste/odor incident, please provide any additional data related to the treatment plant, weather, etc.  Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  ("raw" or "finished" can be put in the appropriate field)  Odor:  Earthy/Musty Taste: Sour/Acidic Chlorinous Salty Grassy/Woody Bitter Marshy/Septic Sweet Fragrant/Flowery Fishy/Aquarium Medicinal Medicinal Medicinal Medicinal Hydrocarbon/Chemical  "Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.   | Other (briefly describe in space to left)  If this is a taste/odor incident, please provide any additional data related to the treatment plant, weather, etc.  Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  ("raw" or "finished" can be put in the appropriate field)  Odor:  Earthy/Musty Taste: Sour/Acidic Salty Grassy/Woody Bitter Grassy/Woody Bitter Fragrant/Flowery Frishy/Aquarium Medicinal Medicinal Hydrocarbon/Chemical  If this is not a taste/odor incident (i.e., fishkill, bloom, etc.), please indicate any other data or information related to the incident (including field conditions, other chemical data, current and preceding weather, etc.). If chemical data are sent to KHEL, please   |  |   |   | _ Lake/Pond  |      |
| Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  ("raw" or "finished" can be put in the appropriate field)  Odor:  Earthy/Musty Taste: Sour/Acidic Chlorinous Salty Grassy/Woody Bitter Marshy/Septic Fragrant/Flowery Fishy/Aquarium Medicinal Medicinal Medicinal Hydrocarbon/Chemical Wouthfeel to the right.  Flease indicate the type of mouthfeel to the right.  | Also check the boxes appropriate to the qualities of the "taste" and "odor" of the finished or raw water.  ("raw" or "finished" can be put in the appropriate field)  Odor:  | Collector Date                         | Time  |   |  |      |
| Chlorinous Salty Grassy/Woody Bitter Marshy/Septic Sweet Fragrant/Flowery Mouthfeel Fishy/Aquarium Medicinal "Mouthfeel" covers a number of characterisitics Hydrocarbon/Chemical of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.   | Chlorinous Salty Grassy/Woody Bitter Marshy/Septic Sweet Fragrant/Flowery Mouthfeel Fishy/Aquarium Medicinal "Mouthfeel" covers a number of characterisitics Hydrocarbon/Chemical "Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.   |  |   |   |  |      |
| Grassy/Woody Marshy/Septic Fragrant/Flowery Fishy/Aquarium Medicinal Medical Mydrocarbon/Chemical Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.  | Grassy/Woody Marshy/Septic Sweet Fragrant/Flowery Mouthfeel Fishy/Aquarium Medicinal Medicinal Medicinal Medicinal Medicinal Medicinal Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.  f this is not a taste/odor incident (i.e., fishkill, bloom, etc.), please indicate any other data or information related to the incident (including field conditions, other chemical data, current and preceding weather, etc.). If chemical data are sent to KHEL, please   | Also check the                         |   |   | d "odor" of the finished or raw water.   |      |
| Marshy/Septic   Sweet  | Marshy/Septic   Sweet  | Also check the<br>("raw" or "finisl    | hed" can be put in the app  | ropriate field)   | Sour/Acidic  |      |
| Fishy/Aquarium  Medicinal  Hydrocarbon/Chemical  "Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.  | FishylAquarium   Medicinal   "Mouthfeel" covers a number of characterisitics   Hydrocarbon/Chemical   of sensation, such as "powdery," "metallic," "burning," etc.   Please indicate the type of mouthfeel to the right.   | Also check the<br>("raw" or "finisl    | Earthy/Musty Chlorinous Grassy/Woody  | ropriate field)   | Sour/Acidic<br>Salty   |      |
| Medicinal "Mouthfeel" covers a number of characterisitics Hydrocarbon/Chemical of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.  | Medicinal "Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," etc. Please indicate the type of mouthfeel to the right.  If this is not a taste/odor incident (i.e., fishkill, bloom, etc.), please indicate any other data or information related to the incident (including field conditions, other chemical data, current and preceding weather, etc.). If chemical data are sent to KHEL, please  | Also check the<br>("raw" or "finish    | Earthy/Musty Chlorinous Grassy/Woody Marshy/Septic  | ropriate field)   | Sour/Acidic Salty Bitter Sweet   |      |
| Please indicate the type of mouthfeel to the right.  | Please indicate the type of mouthfeel to the right.  If this is not a taste/odor incident (i.e., fishkill, bloom, etc.), please indicate any other data or information related to the incident (including field conditions, other chemical data, current and preceding weather, etc.). If chemical data are sent to KHEL, please   | Also check the<br>("raw" or "finisl    | Earthy/Musty Chlorinous Grassy/Woody Marshy/Septic Fragrant/Flowery   | ropriate field)   | Sour/Acidic Salty Bitter Sweet   |      |
|  | If this is not a taste/odor incident (i.e., fishkill, bloom, etc.), please indicate any other data or information related to the incident (including field conditions, other chemical data, current and preceding weather, etc.). If chemical data are sent to KHEL, please  | Also check the<br>("raw" or "finisl    | Earthy/Musty Chlorinous Grassy/Woody Marshy/Septic Fragrant/Flowery Fishy/Aquarium                            | ropriate field)   | Sour/Acidic Salty Bitter Sweet Mouthfeel   |      |
|  | If this is not a taste/odor incident (i.e., fishkill, bloom, etc.), please indicate any other data or information related to the incident (including field conditions, other chemical data, current and preceding weather, etc.). If chemical data are sent to KHEL, please copy Pattie Haines-Lieber, BEFS, on these.   | Also check the                         | Earthy/Musty Chlorinous Grassy/Woody Marshy/Septic Fragrant/Flowery Fishy/Aquarium Medicinal                  | ropriate field)<br>Taste:                                   | Sour/Acidic Salty Bitter Sweet Mouthfeel  "Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," e  | etc. |
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| copy Pattie Haines-Lieber, BEFS, on these.   |  | Also check the ("raw" or "finish Odor: | Earthy/Musty Chlorinous Grassy/Woody Marshy/Septic Fragrant/Flowery Fishy/Aquarium Medicinal Hydrocarbon/Chee | ropriate field)  Taste:  mical  hkill, bloom, etc.), please | Sour/Acidic Salty Bitter Sweet Mouthfeel "Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," e Please indicate the type of mouthfeel to the right. | ent  |
| copy Pattie Haines-Lieber, BEF5, on these.   |  | Also check the ("raw" or "finish Odor: | Earthy/Musty Chlorinous Grassy/Woody Marshy/Septic Fragrant/Flowery Fishy/Aquarium Medicinal Hydrocarbon/Chee | ropriate field)  Taste:  mical  hkill, bloom, etc.), please | Sour/Acidic Salty Bitter Sweet Mouthfeel "Mouthfeel" covers a number of characterisitics of sensation, such as "powdery," "metallic," "burning," e Please indicate the type of mouthfeel to the right. | ent  |

|                |                 | Location        |         |             |               |  |
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| Transfers Rele   | Released By  |        | Date/Time      | Rec               | Received By     |       | Date/Time              | 2        |        | Rece                         | Sample Condition      | e San         | tion<br>npies int | $\vdash$           | Receipt       |          |
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Example of Laboratory Submission/Chain of Custody form - front

## Environmental Chain of Custody Form KEY

Geology, BOW-Industrial Programs, BOW-Livestock Management, BOW-Technical Services, BOW-Watershed Management Section, BOW-Watershed Planning, NW District \*\*Gient: Please pick one of the following – BER Remedial Section, BER Storage Tanks Section, BER Assessment & Restoration Section, BER Surface Mining Section, BOW-Office, NE District Office, NC District Office, SW District Office, SE District Office, SC District Office, BWM-Hazardous Waste Programs, BWM-Solid Waste Programs

Distribution Systems, Point of Entry, Test Source, Supply Source, Private, Sanitary Program, Effluent Monitoring, Non-point pollution Monitoring, Pollution Investigations, Stream Programs, Underground Brine Injection, Pre-treatment Programs, Livestock Special Projects, Livestock Ground Water Projects, Waste Effluent, Waste Influent, Chlorinated PWS, \*\*Profile: Please pick one of the following, which corresponds to client chosen above – State Cooperative Program, USDA Program, Voluntary Cleanup Program, EUC Program, Facilities, Spill Response Program, Dry Cleaning Program, Superfund Program, General ARS, NRD Program, Abandoned Mine Land Program, Active Mining Program, General Site Assessment Program, State Water Plan Program, Brownfields Program, Special Projects, Public Water Supply Unit, Monitoring Unit, Lust Unit, Remedial Unit, Federal Chemistry, Stream Probabilistic, Lakes Monitoring WRAPS, TMDL, Biology Monitoring

\*\*Location Code: Please include project code (e.g. C5-123-1234) as desired on final Report of Analysis. There is a 20-character limit.

\*\*Location Name: Please include location name desired on final Report of Analysis.

\*\*Collector: Please include collector name desired on final Report of Analysis.

Event Desc: Leave blank.

Additional Report Recipients: Please include names and email addresses of additional report recipients desired.

\*\*Sample-ID: Please include unique sample identifier for each sample

\*\*Matrix: Please pick one of the following for each sample – DW-Drinking Water; W-Water; WW-Waste Water; SO-Soil; SL-Soild; or SD-Sediment

\*\*Actual Colection Date/Time: Please include actual collection date and time (military format) for each sample.

\*\*Analyses: Please pick from the following analyses available in the KHEL Environmental Test Catalog — AF Alp/Bet, AF Gamma, PWS Met, S 8080Pest, S 8260 VOC, S Bromide, S Conduct, W DO, W Gamma, W Hardness, W ICP Met, W Mercury, W Mineral, W Nutrient, W RCRA Met, W RCRAnoHg, W Ra226, W Ra228, W Strontiu, W TCIP Met, Gamma, SICP Met, S Mercury, S Nitrate, S RCRA Met, S RCRAnollg, S TCLP Met, S TKN, W 608Pest, W 8080Pest, W 8260 VOC, W Alph/Bet, W BOD), W Bromide, W COD, W W TDS, W TKN, W TOC, W TSS, W Tritium, W Turbid, W Uranium

REQUIRED data for sample submission; all other fields are optional.

## **APPENDIX F**

**Public Water Supply** 

## 2020 Kansas Public Water Supply Harmful Algal Bloom Seasonal Monitoring Program Guide

The Kansas Public Water System (PWS) Harmful Algal Bloom (HAB) Seasonal Monitoring Program is a voluntary program for Water Supply Systems, which provides consistent proactive monitoring for potential toxins through the HAB bloom season. It is intended to provide water systems with important information, so that treatment processes can be modified, or other measures taken to assure safe drinking water is provided to customers. Early detection also allows for timely notification to customers should an event occur.

This Guide provides guidelines on Harmful Algal bloom (HAB) monitoring and sampling periods and protocols, identifies acceptable analytical methods, and identifies cyanotoxin levels that will be used to make advisory decisions and consistent monitoring protocol for public water systems.

## **Human Health Effects of Cyanotoxins**

Adverse health outcomes from exposure to cyanotoxins may range from a mild skin rash to serious illness or death. Acute illnesses caused by exposure to cyanotoxins have been reported, and after short-term exposures, microcystin and cylindrospermopsin could cause liver and kidney damage. The table below summarizes the health effects caused by the most common toxin producing cyanobacteria. The below table is taken from the EPA Health and Ecological Effects website at: <a href="https://www.epa.gov/nutrient-policy-data/health-and-ecological-effects with Saxitoxin information added from the World Health Organization (WHO).">https://www.epa.gov/nutrient-policy-data/health-and-ecological-effects with Saxitoxin information added from the World Health Organization (WHO).</a>

| Cyanotoxins    | Acute Health Effects in<br>Humans   | Most common cyanobacteria producing toxin   |
|----------------|---|---|
| Microcystin-LR | Abdominal pain, Headache, Sore throat, Vomiting and nausea, Dry cough, Diarrhea, Blistering around the mouth, and Pneumonia | Microcystis, Anabaena**, Nodularia, Planktothrix, Fi<br>scherella, Nostoc, Oscillatoria, and Gloeotrichia |

| Cyanotoxins        | Acute Health Effects in<br>Humans  | Most common cyanobacteria producing toxin  |
|--------------------|--|--|
| Cylindrospermopsin | Fever, Headache, Vomiting,<br>Bloody diarrhea  | Cylindrospermopsis raciborskii, Aphanizomenon flos-aquae, Aphanizomenon gracile, Aphanizomenon ovalisporum, Umezakia natans, Anabaena bergii**, Anabaena lapponica, Anabaena planctonica**, Lyngbya wollei, Rhaphidiopsis curvata, and Rhaphidiopsis mediterranea  |
| Anatoxin-a group   | Tingling, burning, numbness, drowsiness, incoherent speech, salivation, respiratory paralysis leading to death*  | Chrysosporum (Aphanizomenon) ovalisporum, Cuspidothrix, Cylindrospermopsis, Cylindrospermum, Dolichospermum, Microcystis, Oscillatoria, Planktothrix, Phormidium, Anabaena flos-aquae**, A. Iemmermannii,** Raphidiopsis mediterranea (strain of Cylindrospermopsis raciborskii), Tychonema and Woronichinia |
| Saxitoxin          | In severe poisoning, illness typically progresses rapidly and may include gastrointestinal (nausea, vomiting) and neurological (cranial nerve dysfunction, a floating sensation, headache, muscle weakness, parasthesias and vertigo) signs and symptoms. Respiratory failure and death can occur from paralysis | Marine dinoflagellates, cyanobacteria in the genera Anabaena**, Aphanizomenon, Planktothrix, Cylindrospermopsis, Lyngbya and Scytonema (Smith et al., 2012; Wiese et al., 2012).   |

<sup>\*</sup> Symptoms observed in animals.

## Numerical Cyanotoxin Thresholds for Drinking Water Health Advisories

In 2015, EPA developed drinking water Health Advisories (HA) for two cyanobacterial toxins. These thresholds will be used to determine when a public health advisory will be issued for a detection of cyanotoxins in finished drinking water. These HAs are not regulations and should

<sup>\*\*</sup>Note: most planktonic Anabaena have now been placed into the genus Dolichospermum

not be construed as legally enforceable federal standards. HAs may change as new information becomes available.

| Cyanatavin         | Drinking Water Health Advisory    | Drinking Water Health Advisory |  |  |
|--------------------|-----------------------------------|--------------------------------|--|--|
| Cyanotoxin         | (10-day)                          | (10-day)                       |  |  |
|                    | Bottle-fed infants and pre-school | School ago children and adulta |  |  |
|                    | children                          | School-age children and adults |  |  |
| Microcystins       | 0.3 μg/L                          | 1.6 μg/L                       |  |  |
| Cylindrospermopsin | 0.7 μg/L                          | 3 μg/L                         |  |  |
| Anatoxin-A         | *                                 | *                              |  |  |
| Saxitoxin          | *                                 | *                              |  |  |

<sup>\*</sup>A few States have determined their own guidance/action levels for Anatoxin-A and Saxitoxin. However, Kansas will continue to follow EPA's Guidance. From:

https://www.epa.gov/nutrient-policy-data/guidelines-and-recommendations

#### Kansas PWS Proposed Monitoring Plan – (Surface Water Sources Only)

- 1. Monitoring Season will run from May through October of each year.
- PWS will conduct initial microcystins monitoring for both raw and finished water during May of each year.
- If no microcystins are detected, the PWS would begin weekly monitoring of raw water at water intake only (i.e. the same location as LT2 Samples are collected or water intake structure)
- 4. If microcystins are detected in the raw water, Contact KDHE PWS-Section immediately (contact information listed below). PWS will then collect a paired raw and finished water microcystins samples within 24 hours of receiving the positive results and complete analysis within five days.
- Depending on the microcystins levels detected, KDHE may instruct PWS to continue weekly monitoring or request increased testing of raw and/or finished water.
   Modifications to water treatment process may be recommended to remove toxins.

- 6. PWS will continue with weekly paired raw and finished water microcystins monitoring until results are below the HA for at least two consecutive weeks or as recommended by KDHE.
- 7. The KDHE PWS Section will subsidize the cost for monitoring. The current estimated cost for laboratory analysis is approximately \$100.00 per sample. The cost to your PWS system will be no more than \$25.00 per sample. This cost may be lower depending upon the number of participating PWS systems.
- 8. PWS systems that choose not to participate in the voluntary routine monitoring program will still be eligible to use Kansas Health and Environmental Laboratories (KHEL) for special samples if a HAB occurs in their source water, however there may delays in sample collection due to sample bottle scheduling and shipping and the cost is estimated at \$75.00 per sample.

#### **KDHE PWS HAB Contact Information**

Questions regarding KDHE monitoring for public water supplies or to report possible Hazardous Algal Bloom or positive test results contact:

During Normal Business Hours (8:00 to 5:00pm, M-F):

Robert Gavin, Ph. 785-296-0643, rob.gavin@ks.gov

Amelia Springer, Ph. 785-296-5523, amelia.springer@ks.gov

Cathy Tucker-Vogel, Ph. 785-368-7130, cathy.tucker-vogel@ks.gov

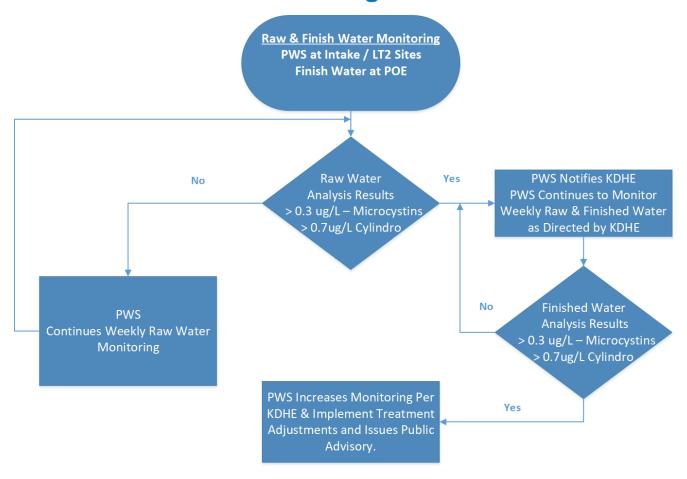
After Hours or Weekend/ Holidays contact (24/7):

KDHE Spill Hotline, 785-296-1679

For additional information related to cyanotoxins management for public water supply systems please refer to the following Environmental Protection Agency Website:

https://www.epa.gov/ground-water-and-dringking-water/cyanotoxins-drinking-water

# PWS-KDHE Voluntary HAB Monitoring Program Flow Diagram



#### **Public Notification Procedure**

Public notification for total microcystins will be conducted in accordance with the provisions contained in this section. Should an exceedance of the 2015 EPA Health Advisory occur in the finish water or distribution system samples, Contact KDHE PWS-Section immediately.

KDHE will assist the PWS to issue an immediate Tier 1 public Advisory (24-hour notification) informing all customers of the situation. If requested, a public notice template may be provided by KDHE containing the appropriate health effects language and use restrictions.

The geographic area under public notification may be limited based on distribution sample results and provisions described in the system's written contingency plan. Distribution sampling results may also be a consideration when modifying use restrictions or lifting the advisory.

#### **Contingency Planning**

KDHE encourages public water systems to work with KDHE, their local emergency management agency, and local health departments to develop a coordinated response to cyanotoxin detections in finished water above EPA designated health advisory Levels. A detailed response protocol should be included in the contingency plans of those PWSs using surface water sources susceptible to a harmful algal bloom.

Items the water system should address in their contingency plan include a communication strategy, including 24-hour emergency contacts, identification of critical users/possible susceptible populations, and considerations for water restrictions or connections to a backup water system. KDHE can provide additional guidance if requested.

#### **Helpful Links for PWS**

Managing Cyanotoxins in Public Drinking Water Systems

https://www.epa.gov/ground-water-and-drinking-water/managing-cyanotoxins-public-drinking-water-systems

Drinking Water Cyanotoxin Risk Communication Toolbox

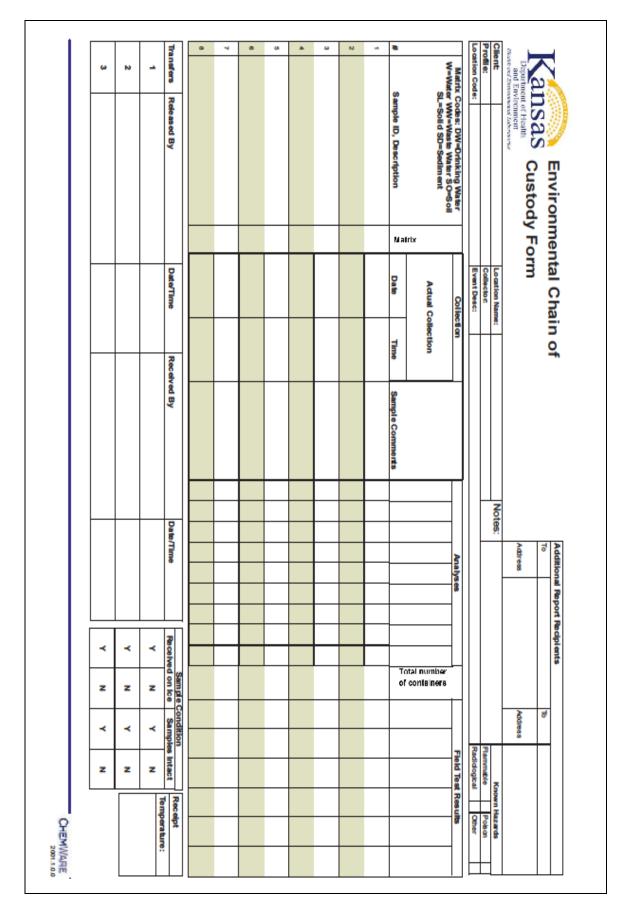
https://www.epa.gov/ground-water-and-drinking-water/drinking-water-cyanotoxin-risk-communication-toolbox

Cyanotoxin tools -Management Plan Template

https://www.epa.gov/ground-water-and-drinking-water/what-cyanotoxin-tools-are-available-public-water-systems

Ohio EPA HAB Website

https://epa.ohio.gov/ddagw/HAB



Front of form

# **Environmental Chain of Custody Form KEY**

Geology, BOW-Industrial Programs, BOW-Livestock Management, BOW-Technical Services, BOW-Watershed Management Section, BOW-Watershed Planning, NW District \*\* dient: Please pick one of the following – BER Remedial Section, BER Storage Tanks Section, BER Assessment & Restoration Section, BER Surface Mining Section, BOW-Office, NE District Office, NC District Office, SW District Office, SE District Office, SC District Office, BWM-Hazardous Waste Programs, BWM-Solid Waste Programs

Distribution Systems, Point of Entry, Test Source, Supply Source, Private, Sanitary Program, Effluent Monitoring, Non-point pollution Monitoring, Pollution Investigations, Stream Programs, Underground Brine Injection, Pre-treatment Programs, Livestock Special Projects, Livestock Ground Water Projects, Waste Effluent, Waste Influent, Chlorinated PWS, \*\*Porfile: Please pick one of the following, which corresponds to client chosen above - State Cooperative Program, USDA Program, Voluntary Cleanup Program, EUC Program, Facilities, Spill Response Program, Dry Cleaning Program, Superfund Program, General ARS, NRD Program, Abandoned Mine Land Program, Active Mining Program, General Site Assessment Program, State Water Plan Program, Brownfields Program, Special Projects, Public Water Supply Unit, Monitoring Unit, Lust Unit, Remedial Unit, Federal Chemistry, Stream Probabilistic, Lakes Monitoring WRAPS, TMDL, Biology Monitoring

\*\*Location Code: Please include project code (e.g. C5-123-1234) as desired on final Report of Analysis. There is a 20-character limit.

\*\*Location Name: Please include location name desired on final Report of Analysis.

\*\*Collector: Please include collector name desired on final Report of Analysis.

Event Desc: Leave blank

Additional Report Recipients: Please include names and email addresses of additional report recipients desired.

\*\*Sample-ID: Please include unique sample identifier for each sample.

\*\*Math: Please pick one of the following for each sample – DW-Drinking Water; W-Water; WW-Waste Water; SO-Soil; SL-Soild; or SD-Sediment

\*\*Actual Colection Date/Time: Please include actual collection date and time (military format) for each sample.

\*\*Analyses: Please pick from the following analyses available in the KHB. Environmental Test Catalog – AF Alp/Bet, AF Gamma, PWS Met, S 8080Pest, S 8260 VCC, S Bromide, S Conduct, W DO, W Gamma, W Hardness, W ICP Met, W Mercury, W Mineral, W Nitrate, W Nutrient, W RCRA Met, W RCRAnoHg, W Ra226, W Ra228, W Strontiu, W TCIP Met, Gamma, SICP Met, S Mercury, S Nitrate, S RCRA Met, S RCRAnoHg, S TCLP Met, S TKN, W 608Pest, W 8080Pest, W 8260 VOC, W Alph/Bet, W BOD, W Bromide, W COD, W W TDS, W TKN, W TOC, W TSS, W Tritium, W Turbid, W Uranium

REQUIRED data for sample submission; all other fields are optional.

#### **APPENDIX G**

Public Health Release Example



Division of Environment Curtis State Office Building 1000 SW Jackson St., Suite 400 Topeka, KS 66612-1367

Lee A. Norman, M.D., Secretary

Phone: 785-296-1535 Fax: 785-559-4264 www.kdheks.gov

Laura Kelly, Governor

#### For Immediate Release

September 12, 2019

For more information, contact: Kristi Zears Kristi.Zears@ks.gov 785-296-1317

Ron Kaufman Ron.Kaufman@ks.gov 785-296-2870

#### Public Health Advisories for Kansas Lakes Due to Blue-Green Algae

13 lakes with warnings; nine with watches; four lifted

**TOPEKA** – The Kansas Department of Health and Environment (KDHE), in conjunction with the Kansas Department of Wildlife, Parks and Tourism (KDWPT), has issued public health advisories for Kansas lakes.

#### Warnings:

Gathering Pond near Milford (Hatchery Supply Pond), Geary County (unchanged)

Hiawatha City Lake, Brown County (unchanged)

Hodgeman County State Fishing Lake, Hodgeman County (unchanged)

Jerry Ivey Pond, Saline County (unchanged)

La Cygne Lake, Miami County (new 9/6)

Lake Afton, Sedgwick County (unchanged)

Lakewood Park Lake, Saline County (unchanged)

Lebo Kids' Pond, Coffey County (unchanged))

Marion County Lake, Marion County (unchanged)

Melvern Outlet Pond, Osage County (unchanged)

Melvern Swim Pond, Osage County (unchanged)

Westlake in Gage Park, Shawnee County (unchanged)

Yates Center Kids' Fishing Pond, Woodson County (unchanged)

When a warning is issued, KDHE recommends the following precautions be taken:

- Lake water is not safe to drink for pets or livestock.
- Lake water, regardless of blue-green algae status, should never be consumed by humans.
- Water contact should be avoided.
- Fish may be eaten if they are rinsed with clean water and only the fillet portion is consumed, while all other parts are discarded.
- Do not allow pets to eat dried algae.
- If lake water contacts skin, wash with clean water as soon as possible.
- Avoid areas of visible algae accumulation.

Protect and Improve the Health and Environment of all Kansans

#### Watches:

Big Eleven Lake, Wyandotte County (downgraded from warning 9/12) Camp Hawk Lake, Harvey County (downgraded from warning 9/12) Carousel Lake (Gage Park), Shawnee County (unchanged) Elk Horn Lake, Jackson County (unchanged) Lake Shawnee, Shawnee County (unchanged) Meadowbrook Park Lake, Johnson County (unchanged) Neosho State Fishing Lake, Neosho (downgraded from warning 9/12) Rock Garden Pond (Gage Park), Shawnee County (unchanged) South Lake, Johnson County (unchanged)

#### Lifted:

Warning for La Cygne Lake in Miami County Lifted 9/12 Warning for Marais des Cygnes Wildlife Area in Linn County Lifted 9/12 Watch for Mission Lake in Brown County Lifted 9/12 Watch for Riggs Park Lake in Sedgwick County Lifted 9/12

A watch means that blue-green algae have been detected and a harmful algal bloom is present or likely to develop. People are encouraged to avoid areas of algae accumulation and keep pets and livestock away from the water.

During the watch status, KDHE recommends the following precautions be taken:

- Signage will be posted at all public access locations
- Water may be unsafe for humans/animals
- Avoid areas of algae accumulation and do not let people/pets eat dried algae or drink contaminated water
- Swimming, wading, skiing, and jet skiing are discouraged near visible blooms
- Boating and fishing are safe. However, inhalation of the spray may affect some individuals. Avoid direct contact with water, and wash with clean water after any contact.
- Clean fish well with potable water and eat fillet portion only.

KDHE samples publicly-accessible bodies of water for blue-green algae when the agency receives reports of potential algae blooms in Kansas lakes. Based on sampling results, KDHE reports on potentially harmful conditions.

Kansans should be aware that blooms are unpredictable. They can develop rapidly and may float around the lake, requiring visitors to exercise their best judgment. If there is scum, a paint-like surface or the water is bright green, avoid contact and keep pets away. These are indications that a harmful bloom may be present. Pet owners should be aware that animals that swim in or drink water affected by a harmful algal bloom or eat dried algae along the shore may become seriously ill or die.

For information on blue-green algae and reporting potential harmful algal blooms, please visit www.kdheks.gov/algae-illness/index.htm.

###

Protect and Improve the Health and Environment of all Kansans

#### **APPENDIX H**

**Jar and Stick Tests** 

#### **The Jar and Stick Tests**

#### **Option for testing your pond:**

There are a couple of simple tests that a pond owner or lake manager can do, at no cost, to determine whether a green pond has a blue-green algae community, or if any algal material visible at the water surface is a blue-green surface scum.

**NOTE:** No test is 100% perfect, and that includes the jar test for blue-greens. The test relies on the buoyancy adaptation of most free-floating (planktonic) blue-green algae. In Kansas, bloom complaints are overwhelmingly the result of the forms that are buoyant. However, there is a small possibility (<2%) that the algae in your particular test happen to be nonbuoyant species for blue-greens, resulting in a false negative test. Likewise, some swimming forms of non-blue-green algae (like Euglenoids) may form a surface layer during a jar test, resulting in a false positive. Fortunately, most Euglena blooms will be reddish in color rather than green, allowing for their identification. Although the jar test does provide a guick and inexpensive way to confirm whether you have a blue-green community in your lake, it does not tell you what species are present, nor does it tell you whether they are actually producing toxins. Be aware, too, that just having blue-green algae present does not mean your pond is automatically hazardous. Many lakes and ponds in Kansas typically have blue-green algae in them. Hazardous conditions occur when the number of blue-green algae is large, and composed of species capable of generating toxins. For that information, a microscopic examination of the water, combined with a chemical test for toxins, would be required for a more complete picture.

The Kansas Department of Health and Environment only tests samples from public waterbodies. Kansas State Veterinary Diagnostic Lab can assist with issues regarding private waterbodies. If you are conducting one or both of these tests on your private farm pond or lake and you determine that you do have a blue-green bloom occurring in your pond, you may obtain further assistance by contacting them.

#### THE JAR TEST PROCEDURE

#### **Purpose**

Look out over the pond and see if the water looks very green. To decide whether the "green" is blue-green algae in the pond, or just an overabundance of some of the more beneficial types of planktonic algae, a simple test can be conducted called the "jar test."

Follow this step by step process to make an initial assessment of the pond in question.

#### **Materials**

- Clear jar (pint to quart size) A Mason (canning) jar or a store-bought pickle jar with the label removed works well.
- Rubber or latex gloves.
- Plastic bag or other containment device

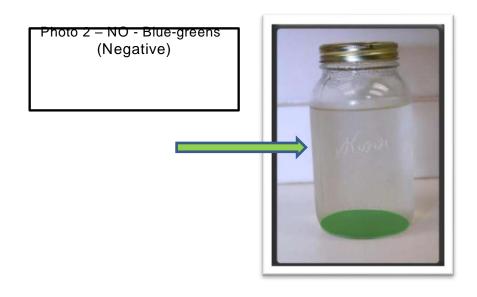
#### **Procedure**

- 1. Find an appropriate <u>clear</u> glass jar with a screw top lid.
- 2. For safety reasons, use rubber or latex gloves to collect a sample of water from the pond in question to prevent skin exposure.
- **3.** Collect the water just below the surface of the water.
  - a. DO NOT collect sample directly from the surface but collect just under the surface to avoid collecting just the scum on the top layer of the water.
- **4.** Fill the jar about <sup>3</sup>/<sub>4</sub> of the way full with the pond water. (See Photo 1.)
  - (<u>DO NOT</u> fill the jar completely to the top. Algae will give off gases and may cause of buildup of pressure inside the jar causing it to break.)
- 5. Wipe off any scum that may be on the outside of the jar.
- **6.** Screw the lid onto the jar.

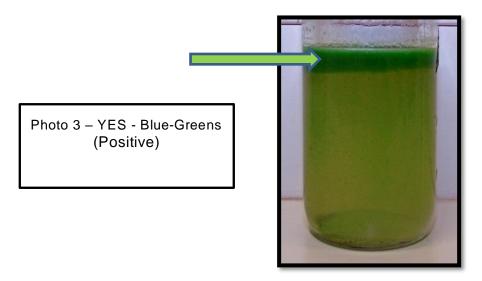
Photo 1 – Initial Samples



- 7. Be aware that the jar may be contaminated with any toxins present in the water. To avoid contamination of other surfaces, place the jar in a plastic bag or other containment device.
- 8. Place the jar in a cold refrigerator and leave it completely undisturbed overnight.
- **9.** The next day, <u>carefully</u> remove the jar from the refrigerator and look to see where the algae have accumulated.
  - a. <u>IT IS VERY IMPORTANT</u> that you do not shake or agitate the jar in any way. If you do, this will mix the algae into the water again and you will <u>not</u> get usable test results.
- **9.** If the algae are all settled out near the bottom of the jar, then that is a likely indication that the lake does <u>not</u> have a lot of blue-green algae growing in it. (See arrow on Photo 2.)



If the algae have formed a green ring around the top of the water in the jar, or just seem to be collected at the air/water divide, there is a strong possibility that the pond does have a bluegreen algae community present. (See arrow on Photo 3.)



#### THE STICK TEST PROCEDURE

#### **Purpose**

Look out over the pond and see if a mat of green material is floating on the surface. Is it bluegreen algae forming a surface scum, or is it a mat of floating filamentous green algae (often called "fisherman's moss" or "string algae")? A simple test to determine what the material might be is called the "stick test."

#### **Materials**

- Sturdy stick Make sure it is long enough to reach into the water without getting algae on your hands.
- Rubber or latex gloves

#### **Procedure**

- 1. Find a sturdy stick.
- 2. Put rubber or latex gloves on before attempting to retrieve a sample of the green material from the pond to prevent skin exposure.
- 3. Thrust the stick into the surface mat and slowly lift out of the water.
  - a. Make sure you do not fall into the water while attempting to retrieve material.
- 4. Look at the end of the stick to see what came out of the water.
  - a. If the stick comes out looking like it has been thrust into a can of paint, the mat on the pond is likely to be a blue-green algae scum.
  - b. If the stick pulls out strands that look like green hair or threads, the mat on the pond is likely filamentous green algae. (Although filamentous green algae can be a nuisance when over-abundant, they do not pose a danger to your health.) (See Photo 1.)

Photo 1 - Filamentous algae



**Note:** The stick test can fail when a particular type of blue-green alga is present. This type of algae is called *Lyngbya wollei*. This species of blue-green algae can form tough filamentous mats that float to the surface, similar to the mats formed by harmless filamentous green algae. However, *Lyngbya wollei* typically will have a very putrid sewage-like odor, which filamentous green algae do not. *Lyngbya wollei* mats also will often release a purple pigment in the water around them, which is something filamentous algae do not do. (See Photo 2.)

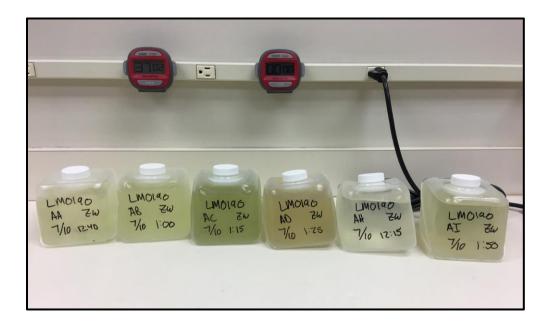


Photo 2 - Lyngbya wollei

#### **APPENDIX I**

**Taxonomic Analysis Priority** 





In each picture shown above, the samples were from different sampling locations in one lake. In this instance, KDHE will test all samples for their levels of microcystin. In cases of limited resources, KDHE may choose the sample with the appearance of the highest level of bluegreen algae for taxonomic (cell count) analysis. If it is difficult to tell visually which sample has the most blue-green algae, KDHE will use best professional judgement to determine which sample is likely to have the most negative impact on human health. Data informing this decision could be the importance of the location for human health, wind conditions during sampling, reporting from the field, photographic evidence, jar test results, or previous analysis results. In the event that resources are limited, an initial toxin analysis can preclude taxonomic analysis (i.e. in the event that two consecutive toxin tests are necessary to downgrade an advisory from a "Warning" to a "Watch," a toxin test alone can be performed.)

#### **APPENDIX J**

#### **Standard Operating Procedures for Algal Samples**

| Procedure   | Last Revised         |  |  |
|---|----------------------|--|--|
| Protocol for Algal Sample Collection (HAB-001)                    | 03/20/20             |  |  |
| Initial Processing of Algal Samples (HAB-002)                     | 02/27/15             |  |  |
| Microcystin Testing Using ELISA Qualitube Kit ET-022 or Equivalen | it (HAB-003)04/01/19 |  |  |

## PROTOCOL FOR ALGAL SAMPLE COLLECTION (HAB-001)

#### I. INTRODUCTION

#### A. Purpose

The following paragraphs describe the procedures for the collection, preservation, and transport of algal samples from water bodies with a validated HAB complaint.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should be an employee of KDHE or a partner agency who has had training/experience in ambient water sampling and field measurement. They must also receive training from KDHE personnel for HAB sample collection protocols.

#### C. Equipment/Accessories

- 1. Cubitainers 1 per sample location
- 2. Amber Glass (TOC), Non-Preserved Bottle 1 per BA sample station ("BA" stations are those associated with raw water intakes for Public Water Supplies)
- 3. Nutrient Bottle 1 per HAB event (when nutrient samples are requested)
- **4.** Waterproof permanent marker
- 5. Pole sampler with attached plastic beaker
- 6. GPS unit
- 7. Paper Towels
- 8. Cooler
- 9. Cold packs or ice
- 10. Zip lock plastic bags for ice if needed
- 11. Tap or distilled water
- 12. Large trash bags
- 13. Map of area
- 14. Personal protective supplies such as gloves, wash water, wading boots, etc.

#### II. PROCEDURES

- **A.** Collection of Algal Samples (one cubitainer per site)
  - Using a pole sampler with an attached beaker, either a "grab" or "composite" sample can be collected.
    - a. "Grab" Samples:
      - 1) Verify that the designated sampling location(s) where a sample is to be collected is representative of a major public access area where the public will have full access to the water.
      - 2) Mark the cubitainer (clear, plastic, 1-liter cube shaped bottle, non-preserved) with the following information:
        - a. Sample Station I.D. number
        - b. Sample Collection Time
        - c. Sample Collection Date
        - **d.** Sample Collector's Name or Initials
      - 3) Inflate the cubitainer. This can be done by removing the cap and gently exhaling into the opening until it completely inflates. (Do not contaminate the cube by expelling saliva into the container.)
      - 4) Submerge the pole sampler's beaker open end down through the water until completely submerged. Slowly turn the sample pole until the beaker is sideways and approximately 1-2" under the water's surface. Once the beaker is filled, pull the sample pole and attached beaker out of the water.
      - 5) Pour collected sample into the inflated cubitainer. It generally takes two of these processes to fill one cubitainer.
      - **6)** Leave a headspace in the container of at least ½" for gas expansion.
      - 7) Secure the lid and wipe the cubitainer until it is clean and dry. Place in a plastic zip lock bag and then in a cooler.
      - 8) Move to your next sampling location.
      - 9) If sample collection is required in the future at that same public access area, then collect as close as possible to that exact point. (Do not "chase the

scum" that might appear a few feet away from your original sampling point.) This will maintain consistency of the sampling activities.

#### **b.** "Composite" Samples:

- 1) Verify that the designated sampling location(s) where a sample is to be collected is representative of a major public access area where the public will have full access to the water.
- 2) Mark the cubitainer (clear, plastic, 1-liter cube shaped bottle, non-preserved) with the following information:
  - a. Sample Station I.D. number
  - b. Sample Collection Time
  - c. Sample Collection Date
  - d. Sample Collector's name or initials
- 3) Inflate the cubitainer. Inflating the cubitainer can be done by removing the cap, gently exhaling into the opening until it completely inflates. (Do not contaminate the cube by expelling salvia into the container.)
- 4) Submerge the pole sampler's beaker open end down through the water until completely covered. Slowly turn the sample pole until the beaker is sideways and approximately 1 -2" under the water's surface. Once the beaker is filled pull the sample pole and attached beaker out of the water.
- 5) Pour collected sample into a clean bucket. Continue this process collecting samples from various locations around the dock, (e.g., one from each side of the dock).
- 6) Once all samples have been collected and poured into the bucket, swirl the bucket to mix.
- 7) Pour the mixed sample into the inflated cubitainer.
- 8) Leave a headspace in the container of at least  $\frac{1}{2}$  for gas expansion.
- 9) If sample collection is required in the future at that same public access area, then collect as close as possible to that exact initial point. (Do not "chase the scum" that might appear a few feet away from your original sampling point.)

  This will maintain consistency of the sampling activities.
- **B.** Collection of Samples for Drinking Water Analysis (one glass non-preserved TOC bottle):

- 1. Using a pole sampler with an attached beaker or bucket with rope and swivel, a BA sample can be collected.
- 2. Verify that the designated sampling location(s) is representative of where a public water supply system would be pulling their raw water samples.
- **3.** Mark the sample bottle (amber, glass, TOC bottle, non-preserved) with the following information:
  - a. Sample location I.D. number
  - **b.** Sample Collection Time
  - c. Sample Collection Date
  - d. Sample Collector's Name or Initials
- **4.** Remove the cap.
- 5. Submerge the pole sampler's beaker open end down through the water until completely covered. Slowly turn the sample pole until the beaker is sideways and approximately 1-2" under the water's surface. Once the beaker is filled pull the sample pole and attached beaker out of the water. Do the same process for a bucket and rope.
- **6.** Pour collected sample into the glass bottle.
- 7. Leave a headspace in the container of no less than  $\frac{1}{2}$  for gas expansion.
- **8.** Secure the lid and wipe the bottle until it is clean and dry. Place in a cooler.
- **9.** Move to your next sampling location.
- **10.** If sample collection is required in the future at that same public access area, then collect as close as possible to that exact initial point. (Don't go chasing scum that might appear a few feet away from your original sampling point.) This will maintain consistency of the sampling activities.
- **C.** Collection of Nutrient Samples (one Cubitainer and one Nutrient bottle per site):
  - 1. Using a clean pole sampler with an attached beaker, collect a "grab" sample.
    - **a.** Nutrient samples will be collected <u>only</u> from designated locations believed representative of the lake's normal ambient sampling station. Verify that the location where the sample is to be collected is at the normal ambient sampling station or as close as possible to that station location.

- **2.** Mark both the nutrient container, (brown, opaque, plastic 250 milliliter bottle, Sulfuric Acid preserved) and a cubitainer with the following information:
  - **a.** Sample location I.D. number
  - **b.** Sample Collection Time
  - c. Sample Collection Date
  - **d.** Sample Collector's name or initials
- 3. Submerge the beaker's open end down through the water until completely covered. Slowly turn the sample pole until the beaker is sideways and approximately 1-2" under the water's surface. Once the beaker is filled pull the sample pole and attached beaker out of the water.
- **4.** Carefully open the Nutrient bottle. (The bottle contains a Sulfuric Acid preservative and will burn the skin or clothing.)
- **5.** Slowly pour collected sample into the bottle making sure not to overfill as a loss of preservative will affect the integrity of the sample.
- **6.** Secure the lid tightly and wipe clean and dry. Place the sample container in a zip lock bag and secure bag. (Placing the container in its own individual bag will minimize the potential of cross contamination).
- **7.** Follow the "How to Collect Phytoplankton Samples" directions to fill the cubitainer for nutrients.
- **8.** Place containers in a cooler.

\*\*\*REMINDER: All samples collected should be taken 1 to 2 inches under the water surface. Samples do not need to be taken at deeper depths when sampling for bluegreen algae. Do not collect the sample at the surface (the air/water interface).

- **D.** Cleaning Equipment Between Samples:
- 1. "Between Sampling Locations at the Same Waterbody"
  - **a.** After the sample has been collected, discard any remaining water from sampling equipment.
  - **b.** Wipe all equipment dry with paper towel
  - **c.** Once at the next sampling location, rinse sampling equipment with ambient water at a different, but nearby, location that is different from but near the location where the sample is to be collected.
  - **d.** Discard rinse water, then move to sampling location to collect sample.

#### 2. "Between Different Water Bodies"

- a. Clean all sampling equipment with tap water.
- **b.** Once at sampling location, rinse sampling equipment several times with ambient water at a location that is different from but near the location where the sample is to be collected.
- **c.** Discard rinse water, then move to sampling location to collect sample.
- **d.** Follow the above directions if additional samples are to be collected at the same waterbody.

#### E. Preparing Samples for Shipment:

- **1.** Wipe dry the exterior of all cubitainers.
- 2. Place all containers in a cooler along with a cold pack(s). If ice is used, double bag it first before placing in the cooler. This will minimize the potential of cross-contamination or making a mess when the ice melts. Plastic pop bottles filled with water and then frozen can also be used in place of cold packs. Place enough cold packs or ice in the cooler to keep the samples cool. DO NOT FREEZE THE SAMPLES.
- **3.** Fill out the algae and/or the KHEL PWS submission/chain-of-custody form (see **Appendix E**). When filling out the algae sampling form, include environmental conditions at time of sampling, *e.g.*, water and air temperature, wind speed/direction, cloud cover, any unusual conditions.
- **4.** If the samples are to be delivered by a carrier company, then place the submission form(s) inside a plastic bag and tape to the inside the lid of the cooler.
- 5. If samples are to be transported to the lab(s) by the collector or handed off to another partner, then place the submission form(s) inside a plastic bag and tape to the OUTSIDE the cooler so it is readily accessible for additional chain of custody signatures.
- **6.** Secure the cooler.

#### **D.** Shipment of Samples:

- 1. Samples must be shipped no later than overnight.
- 2. At any time that the samples exchange to a different handler, then the chain-of-custody must be signed. Exception is if shipment is sent by commercial carrier, then note which company the samples were "relinquished to ..."

**3.** All algae samples are to be delivered or sent to:

Kansas Dept of Health and Environment

BOW-WPMAS HAB Program

1000 SW Jackson

Suite 420

Topeka, Kansas 66612-1367

4. All nutrient samples are to be sent to:

KHEL Laboratories

Forbes Field, Building 740

Topeka, Ks. 66620-0001

**5.** If necessary, Public Drinking Water samples will be taken to the Kansas Health and Environmental Lab by BOW/PWS staff, for those not analyzed by BOW-WPMAS.

If samples are shipped by carrier, to minimize shipping costs, send all samples to BOW/BEFS, including nutrient samples and we will carry the nutrient samples to the lab.

Further questions? Contact:

#### 2020 HAB response team and sample analysis team:

Elizabeth Smith – (785) 296-4332 William Blair – (785) 296-0079 Britini Jacobs – (785) 296-5576 Layne Knight – (785) 291-3885 Tony Stahl – (785) 296-5578

#### Policy:

Tom Stiles 785-296-5500

**HAB Hotline:** 

(785) 296-1664

## INITIAL PROCESSING OF ALGAL SAMPLES (HAB – 002)

#### I. INTRODUCTION

#### A. Purpose

The following paragraphs describe the procedure for the collection, preservation, and transport of algal samples from water bodies with a validated HAB complaint.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet requirements for State of Kansas Environmental Associate job class and be experienced in the measurement of the physicochemical and microbiological properties of surface water and the performance of environmental field investigations.

#### C. Equipment/Accessories

- 1. Lugol's solution
- 2. Sample bottles with lids
- 3. Yellow round labels
- 4. Chain of Custody sheet

#### II. PROCEDURES

#### A. Receiving samples

- 1. Coolers containing samples will be directed to BOW-WPMAS HAB Response Team or Analytical Support staff. This is usually around 10:00 to 10:30 a.m. on Tuesday or Wednesday, depending upon the carrier bringing in the samples.
- **2.** Upon receiving the coolers, remove the samples and paperwork.
- **3.** Place samples in refrigerator in the Algal ID lab until ready to process. Make sure the refrigerator door closes completely.
- **4.** On the back of the Algae Sample Submission Form (see **Appendix E**) and under the Chain of Custody section, date and sign by the Received By line.
- **5.** The Algae Sample Submission Forms are to be kept with the samples and are placed by the algal taxonomist's scope. Once sample analysis is completed, then the Sample Submission Form is to be filed by year with the lake reports.

#### B. Algal Preservation

1. When ready to process samples, remove them from the refrigerator and place on the black shelving unit in middle of Algal ID lab room in the order in which they will be processed.

- 2. In the drawer directly to the left of the sink, remove the yellow, round stickers and a pencil to mark each bottle used to preserve samples.
- **3.** In the chlorophyll lab room (small room) and directly to the left of the door on a cart, remove one bottle for each sample to be preserved. Lids to the bottles are in the far-right bottom cabinet and on the bottom shelf.
- 4. Line the bottles and lids up on the counter by the refrigerator in the Algal ID lab. Write on the yellow stickers the lake number and sampling point (for example Milford would be 190 as the lake number and AA is one of the sample points). Place the stickers on top of the lids prior to preserving sample.
- 5. In the same room and under the sink is the brown Lugol's container. It has a small needleless syringe attached to it. Place 5 drops of Lugol's in each bottle. Be careful with this as Lugol's does stain just about everything it comes in contact with, including the counter, hands, and clothes. Place bottle back under the sink.
- 6. Take the first sample and shake cubitainer vigorously to thoroughly mix the water and contents. Over the sink, carefully pour sample water into one of the small bottles containing the Lugol's until it is about to the line where the neck begins (about ¼ inch from the top). Double check that the lid you put on the bottle matches the sample you poured into it. Screw that lid onto the bottle securely.
- 7. A portion of the sample will need to be frozen to conduct the Elisa toxicity test so pour a good portion of the sample down the drain but retain at least a ½ inch in the bottom of the cubitainer.
- **8.** Continue this process with all the remaining samples.
- **9.** Place the preserved samples on the table with the algal taxonomist's microscope.
- **10.** Place the cubitainers with the saved water into the freezer in the main lab (middle) room. Make sure the lid to the freezer is closed tightly.

# MICROCYSTIN TEST USING ELISA QUALITUBE KIT ET-022 OR EQUIVALENT (HAB – 003)

#### I. INTRODUCTION

#### A. Purpose

The following paragraphs describe the procedures for the collection, preservation, and transport of algal samples from water bodies with a validated HAB complaint.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

#### C. Equipment/Accessories

- 1. Envirologix qualitube kit for Microcystin.
- 2. Wooden block or test tube rack to place tubes in for analysis.
- 3. Timer.
- 4. Use of water in sink area.
- **5.** Thawed water samples from freezer of lakes that are under investigation.
- 6. Paper and Pencil.
- 7. HACH Pocket Colorimeter™ II Analysis Systems 450 nm, 59530-45; with a 1 cm tube cell adapter
- 8. Kimwipes
- **9.** Adjustable pipette (0.1 1.0 mL) and disposable tip

#### II. PROCEDURES

#### A. Preliminary procedures:

- 1. Remove frozen samples from freezer to begin thawing.
- 2. Read all the instructions before running the kit.
- **3.** Allow all reagents to reach room temperature before beginning (at least 30 minutes with un-boxed tubes and reagents at room temperature do not remove tubes from bag with desiccant until they have warmed up).
- **4.** Organize all samples and reagents so that steps 1 and 2 can be performed in 3 minutes or less.
- 5. Do not run more than 6 tubes at a time.

#### **B.** Dilutions

- 1. To complete the assay in a timely manner, it may be helpful to dilute samples that are potentially high in toxin before testing them (*i.e.* based on previous week's analysis results, or based on visual appearance of sample). A dilution of 1:5 is often a good starting place; samples that do not fall within the absorbance range of the calibrators will need to be diluted at a different level.
- **2.** A list of common dilutions is printed in the ELISA book, and include:

| Ratio | Sample (mL) | DI Water (mL) | Dilution multiplier |
|-------|-------------|---------------|---------------------|
| 1:1   | 0.5         | 0.5           | x 2                 |
| 1:2   | 0.5         | 1             | x 3                 |
| 1:3   | 0.5         | 1.5           | x 4                 |
| 1:4   | 0.5         | 2             | x 5                 |
| 1:5   | 0.5         | 2.5           | x 6                 |
| 1:6   | 0.5         | 3             | x 7                 |
| 1:7   | 0.5         | 3.5           | x 8                 |

**3.** Multiply the resultant concentration by the dilution multiplier to find the actual concentration of the sample.

#### **C.** Completing the assay.

1. Place tubes in wooden tube rack. The Calibrator tubes are the two tubes behind the six in front. These will be the tubes used to compare color intensity between 0.5 ppb and 3.0 ppb results. See Photo below.



- 2. Rapidly add 5 drops of Microcystin Assay diluent to each tube in the assay.
- 3. Using the sample pipette provided, immediately add 2 drops of 0.5 ppb Microcystin *calibrator* to the first tube. Add 2 drops of 3.0 ppb Microcystin *calibrator* into the second tube. Add 2 drops of sample to each of the subsequent

tubes up to a total of 4 samples. **Do Not Add Microcystin-enzyme conjugate in this step.** 

- **4.** Thoroughly mix the contents of the tubes by moving the tube holder in a rapid circular motion on flat surface for a full 20 30 seconds.
- **5.** Incubate tubes at ambient temperature for 5 minutes.
- **6.** Add **5 drops of Microcystin-enzyme** *conjugate* to each tube. Do not empty the tub contents or wash the tubes at this time. Thoroughly mix the contents of the tubes as in step 3.
- 7. Incubate tubes at ambient temperature for 20 minutes.
- **8.** After incubation, vigorously shake the contents of the tubes into a sink or other suitable container. Flood the tubes completely with cool tap water, and then shake to empty. Repeat this wash step 3 times. Invert the tubes on a paper towel and tap to remove as much water at possible.
- **9.** Add **10 drops of** *Substrate* to each tube. Thoroughly mix the contents of the tubes, as in Step 3. Incubate substrate in tubes for 10 minutes at ambient temperature.

### NOTE: If blue color does not develop in the 0.5 ppb Calibrator tube, the assay is invalid and should be repeated.

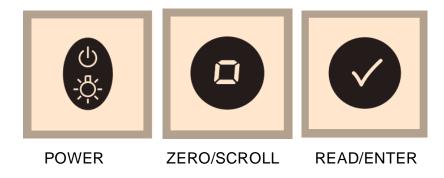
- **10.** This assay is designed to be read visually with un-stopped tubes (blue solution). If tubes are to be read using the tube colorimeter, pipette 0.7 mL of Stop Solution into each tube and mix thoroughly. This will turn the tube contents yellow.
  - a. Tubes should be read within 30 minutes of the addition of Stop Solution.
  - **b.** Proceed to step E to interpret the results using a colorimeter.
- **11.** Interpret the results of un-stopped tubes immediately following the 10-minute substrate incubation.
- **D.** Interpreting the results visually.
  - 1. Compare the intensity of the blue color of each sample tube to the intensity of the blue color in the 0.5 and 3.0 ppb calibrator tubes.
  - 2. Score each sample tube as having less than, more than or equal color to the two calibrator tubes.

3. Use the Table below to determine the level of microcystin in the samples.

| Contain                             |  |  |  |
|-------------------------------------|--|--|--|
|                                     |  |  |  |
| Less than 0.5 ppb Microcystin       |  |  |  |
|                                     |  |  |  |
| Between 0.5 and 3.0 ppb Microcystin |  |  |  |
|                                     |  |  |  |
| More than 3 ppb Microcystin         |  |  |  |
|                                     |  |  |  |

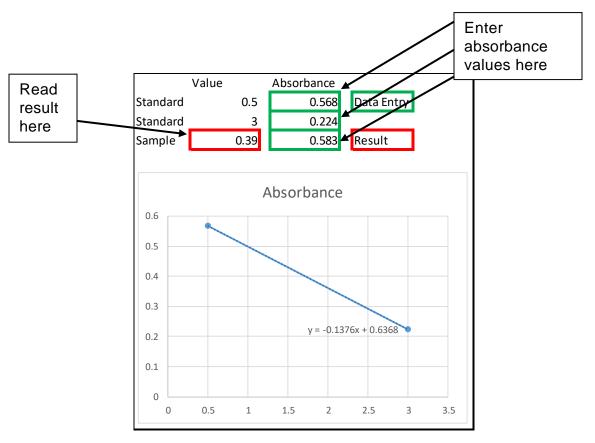
NOTE: For all diluted samples, the test results must be multiplied by the appropriate dilution factor to yield the final concentration of the original sample.

**E.** Interpreting the results using a colorimeter.



- 1. Fill a sample cell to the 10 mL line with DI water.
- 2. Press the POWER button to turn the meter on.
- 3. Remove the meter cap. Wipe excess liquid and finger prints off sample cells using a Kimwipe. Place the blank in the cell holder with the diamond mark facing the keypad. Fit the meter cap over the cell compartment to cover the cell.
- 4. Press ZERO/SCROLL button. The display will show "- - -", then "0.000".
- 5. Check the blank by pressing the READ/ENTER button. The instrument will show "---" followed by the results.
- **6.** Remove the meter cap. Wipe excess liquid and finger prints off sample cells using a Kimwipe. Place the 0.5 calibrator in the cell holder with the diamond mark facing the keypad. Fit the meter cap over the cell compartment to cover the cell.

- 7. Press the READ/ENTER button. The instrument will show "- - " followed by the results. Record the absorbance values in the Laboratory ELISA Assay Work Sheet.
- **8.** Repeat steps 6-7 for the 3.0 calibrator and all the samples. Record the absorbance values in the Laboratory ELISA Assay Work Sheet.
- **9.** To find the results, enter the absorbance values of the calibration cells, and the sample cell into the Envirologix Interpolation excel spreadsheet.



NOTE: For all diluted samples, the test results must be multiplied by the appropriate dilution factor to yield the final concentration of the original sample.

EnviroLogix® ELISA QualiTube assays were used according to manufacturer's specifications to measure total microcystin (detection limit 0.5 µg/L), viewable online at: <a href="http://www.envirologix.com/wp-content/uploads/2015/05/ET022-Microcystin-101215.pdf">http://www.envirologix.com/wp-content/uploads/2015/05/ET022-Microcystin-101215.pdf</a>. EnviroLogix, Portland, Maine.

**F.** If this test kit is not available, then the HAB Response Team will use best professional judgment to identify and perform an equivalent assay.

#### **APPENDIX K**

Lake Visitation Potential

#### LAKE VISITATION POTENTIAL MULTIPLICAND EXPLANATION

In determining a lake's visitation potential, the following equation was used:

## Population 30 x Lake Size Factor x Lake Density Factor x Public Access Factor x Contact Recreation Factor = Lake Visitation Potential

The following table is an explanation of the multiplicands in the above equation:

| Population 30             | Population within 30-mile radius   |                                |                |                         |                      |                   |
|---------------------------|--|--------------------------------|----------------|-------------------------|----------------------|-------------------|
|                           | T  |                                |                |                         |                      |                   |
| Lake Size Factor          | Based on lake size in acres, divided into classes and then assigned size factors:  |                                |                |                         |                      |                   |
|                           | Size Class   |                                | Size Factor    |                         |                      |                   |
|                           | <1 acre  | e =                            | .001           |                         |                      |                   |
|                           | 1 – 5 acres  | s =                            | .01            |                         |                      |                   |
|                           | 5 – 50 acres   | s =                            | = 0.5<br>= 1.0 |                         |                      |                   |
|                           | 50 – 500 acres   | s =                            |                |                         |                      |                   |
|                           | 500 - 1000 acres   |                                |                |                         |                      |                   |
|                           | > 1000 acres   | s =                            |                |                         |                      |                   |
|                           | T  |                                |                |                         |                      |                   |
| Lake Density Factor       | Based on number of lakes within 30 mile diameter and then assign density factors:  |                                |                |                         |                      |                   |
|                           | Number of Lake   | Number of Lakes Density Factor |                | ctor                    |                      |                   |
|                           | 1 to 3 lakes   | s =                            | 1.0            |                         |                      |                   |
|                           | 4 to 6 lakes   | s =                            | 0.8            |                         |                      |                   |
|                           | 7 to 16 lakes  |                                |                |                         |                      |                   |
|                           | > 16 lakes   | s =                            | 0.4            |                         |                      |                   |
| 5 1 11 A                  | T  |                                |                |                         |                      |                   |
| Public Access<br>Factor   |  |                                |                |                         |                      |                   |
|                           | Private Lake   | 0                              | pen to Public  |                         |                      |                   |
|                           | 1.0  |                                | 0.1            |                         |                      |                   |
| Contact Recreation Factor |  |                                |                |                         |                      |                   |
|                           | Definition  Swimming beach/boating/skiing facilities provided.  Swimming/boating facilities not provided but water depth greater than 18 inches. |                                |                | ry Contact<br>inability | Recreation<br>Factor |                   |
|                           |  |                                | Att            | ainable                 | CR A = <b>1.0</b>    |                   |
|                           |  |                                | Att            | ainable                 | CR B = <b>0.5</b>    |                   |
|                           | Waterbody less than 18 inches in depth. Full immersion not likely.   |                                |                | Not A                   | Attainable           | CR a = <b>0.1</b> |

## HAB KANSAS LAKE RANKING FOR VISITATION POTENTIAL

Top 25% in visitation potential are in the shaded rows; Lower 75% are in the unshaded rows

| Lake<br>Name                 | Pop_30 | Acres  | Size Class   | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | æ | Contact<br>Factor | PWS | Final   |
|------------------------------|--------|--------|--------------|----------------|---------|-----------------|---------|---|-------------------|-----|---------|
| Augusta City Lake            | 509828 | 175.7  | 50-500       | 0.500          | 2       | 1.0             | 1.00    | А | 1.0               | Х   | 254914  |
| Augusta Santa Fe Lake        | 535020 | 259.6  | 50-500       | 0.500          | 2       | 1.0             | 1.00    | Α | 1.0               |     | 267510  |
| Banner Creek Lake            | 145753 | 487.1  | 50-500       | 0.500          | 4       | 0.8             | 1.00    | А | 1.0               | Х   | 58301   |
| Big Hill Lake                | 84056  | 1094.3 | >1000        | 2.000          | 2       | 1.0             | 1.00    | Α | 1.0               | Х   | 168112  |
| Bone Creek Lake              | 60750  | 502.6  | 500-<br>1000 | 1.000          | 3       | 1.0             | 1.00    | В | 0.5               | Х   | 30375   |
| Butler Co. SFL               | 99034  | 106.7  | 50-500       | 0.500          | 1       | 1.0             | 1.00    | В | 0.5               |     | 24759   |
| Carey Park Lake              | 152484 | 77.6   | 50-500       | 0.500          | 2       | 1.0             | 1.00    | Α | 1.0               |     | 76242   |
| Cedar Bluff Lake             | 32321  | 4271.9 | >1000        | 2.000          | 1       | 1.0             | 1.00    | Α | 1.0               |     | 64642   |
| Cedar Creek Lake             | 65034  | 308.5  | 50-500       | 0.500          | 3       | 1.0             | 1.00    | А | 1.0               |     | 32517   |
| Cedar Lake                   | 781930 | 62.2   | 50-500       | 0.500          | 11      | 0.6             | 1.00    | В | 0.5               |     | 117290  |
| Chase Co. SFL                | 53635  | 104.1  | 50-500       | 0.500          | 1       | 1.0             | 1.00    | А | 1.0               |     | 26818   |
| Cheney Lake                  | 368923 | 9664.1 | >1000        | 2.000          | 1       | 1.0             | 1.00    | А | 1.0               | Х   | 737846  |
| Clinton Lake                 | 381928 | 7389.9 | >1000        | 2.000          | 4       | 0.8             | 1.00    | А | 1.0               | Х   | 611085  |
| Council Grove City<br>Lake   | 71922  | 387.7  | 50-500       | 0.500          | 2       | 1.0             | 1.00    | А | 1.0               | Х   | 35961   |
| Council Grove Lake           | 77452  | 2730.7 | >1000        | 2.000          | 2       | 1.0             | 1.00    | А | 1.0               |     | 154904  |
| Douglas Co. SFL              | 602250 | 175.8  | 50-500       | 0.500          | 5       | 0.8             | 1.00    | В | 0.5               |     | 120450  |
| Edgerton City Lake           | 717271 | 7.1    | 5-50         | 0.100          | 6       | 0.8             | 1.00    | В | 0.5               |     | 28691   |
| El Dorado Lake               | 173182 | 7697.9 | >1000        | 2.000          | 1       | 1.0             | 1.00    | А | 1.0               | Х   | 346364  |
| Elk City Lake                | 63744  | 3414.6 | >1000        | 2.000          | 2       | 1.0             | 1.00    | Α | 1.0               |     | 127488  |
| Emery Park Lake              | 546896 | 6.6    | 5-50         | 0.100          | 10      | 0.6             | 1.00    | А | 1.0               |     | 32814   |
| Fall River Lake              | 25456  | 2190.9 | >1000        | 2.000          | 2       | 1.0             | 1.00    | А | 1.0               |     | 50912   |
| Fort Scott City Lake         | 62490  | 333.4  | 50-500       | 0.500          | 6       | 0.8             | 1.00    | Α | 1.0               |     | 24996   |
| Gardner City Lake            | 792878 | 105.5  | 50-500       | 0.500          | 10      | 0.6             | 1.00    | А | 1.0               | Χ   | 237863  |
| Geary Co. SFL                | 117663 | 95.6   | 50-500       | 0.500          | 2       | 1.0             | 1.00    | В | 0.5               |     | 29416   |
| Hargis Lake                  | 389436 | 60.2   | 50-500       | 0.500          | 3       | 1.0             | 1.00    | В | 0.5               |     | 97359   |
| Harvey Co. East Lake         | 449243 | 180.8  | 50-500       | 0.500          | 3       | 1.0             | 1.00    | Α | 1.0               |     | 224622  |
| Harvey Co. West Park<br>Lake | 327562 | 12.4   | 5-50         | 0.100          | 1       | 1.0             | 1.00    | А | 1.0               |     | 32756   |
| Herington City Lake          | 65571  | 168.7  | 50-500       | 0.500          | 3       | 1.0             | 1.00    | Α | 1.0               | Х   | 32786   |
| Herington Reservoir          | 61796  | 522.5  | 500-<br>1000 | 1.000          | 3       | 1.0             | 1.00    | А | 1.0               |     | 61796   |
| Heritage Park Lake           | 738651 | 38.9   | 5-50         | 0.100          | 11      | 0.6             | 1.00    | А | 1.0               |     | 44319   |
| Hillsdale Lake               | 647463 | 4295.0 | >1000        | 2.000          | 5       | 0.8             | 1.00    | Α | 1.0               | Х   | 1035941 |
| Inman Lake                   | 137270 | 133.4  | 50-500       | 0.500          | 2       | 1.0             | 1.00    | В | 0.5               |     | 34318   |
| John Redmond Lake            | 61949  | 8158.4 | >1000        | 2.000          | 3       | 1.0             | 1.00    | Α | 1.0               |     | 123898  |
| Kanopolis Lake               | 91811  | 2933.5 | >1000        | 2.000          | 1       | 1.0             | 1.00    | Α | 1.0               | Χ   | 183622  |

| Lake<br>Name        | Pop_30 | Acres   | Size Class   | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | CR | Contact<br>Factor | PWS | Final<br>Score |
|---------------------|--------|---------|--------------|----------------|---------|-----------------|---------|----|-------------------|-----|----------------|
| Kirwin Lake         | 15952  | 1535.1  | >1000        | 2.000          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 31904          |
| La Cygne Lake       | 49815  | 2371.2  | >1000        | 2.000          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 49815          |
| Lake Afton          | 506353 | 249.9   | 50-500       | 0.500          | 2       | 1.0             | 1.00    | Α  | 1.0               |     | 253177         |
| Lake Crawford State |        |         |              |                |         |                 |         |    |                   |     |                |
| Park #2             | 65383  | 120.2   | 50-500       | 0.500          | 4       | 0.8             | 1.00    | Α  | 1.0               |     | 26153          |
| Lake Shawnee        | 315903 | 378.2   | 50-500       | 0.500          | 12      | 0.6             | 1.00    | Α  | 1.0               |     | 94771          |
| Leavenworth Co.     |        |         |              |                |         |                 |         |    |                   |     |                |
| SFL                 | 811776 | 150.7   | 50-500       | 0.500          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 202944         |
| Lebo City Lake      | 65139  | 63.2    | 50-500       | 0.500          | 3       | 1.0             | 1.00    | Α  | 1.0               |     | 32570          |
| Lone Star Lake      | 368604 | 175.6   | 50-500       | 0.500          | 4       | 0.8             | 1.00    | Α  | 1.0               |     | 147442         |
| Louisburg Old Lake  | 481872 | 22.0    | 5-50         | 0.100          | 3       | 1.0             | 1.00    | Α  | 1.0               |     | 48187          |
| Louisburg SFL       | 262726 | 269.0   | 50-500       | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 65682          |
| Lovewell Lake       | 11987  | 2626.8  | >1000        | 2.000          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 23974          |
| Madison City Lake   | 54446  | 94.6    | 50-500       | 0.500          | 1       | 1.0             | 1.00    | Α  | 1.0               | Х   | 27223          |
| Marion Co. Lake     | 54200  | 123.4   | 50-500       | 0.500          | 2       | 1.0             | 1.00    | Α  | 1.0               |     | 27100          |
| Marion Lake         | 63460  | 6195.8  | >1000        | 2.000          | 3       | 1.0             | 1.00    | Α  | 1.0               | Χ   | 126920         |
| Melvern Lake        | 85020  | 6221.7  | >1000        | 2.000          | 5       | 0.8             | 1.00    | Α  | 1.0               | Χ   | 136032         |
| Miami Co. SFL       | 106927 | 110.1   | 50-500       | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 26732          |
| Milford Lake        | 121813 | 15182.0 | >1000        | 2.000          | 1       | 1.0             | 1.00    | Α  | 1.0               | Χ   | 243626         |
| Miola Lake          | 445952 | 182.7   | 50-500       | 0.500          | 5       | 0.8             | 1.00    | Α  | 1.0               |     | 178381         |
| Mission Lake        | 52543  | 136.5   | 50-500       | 0.500          | 3       | 1.0             | 1.00    | Α  | 1.0               |     | 26272          |
| New Olathe Lake     | 798253 | 141.8   | 50-500       | 0.500          | 12      | 0.6             | 1.00    | Α  | 1.0               |     | 239476         |
| Olpe City Lake      | 51343  | 75.3    | 50-500       | 0.500          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 25672          |
| Osage City          |        |         |              |                |         |                 |         |    |                   |     |                |
| Reservoir           | 159618 | 50.3    | 50-500       | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               | Χ   | 39905          |
| Osage Co. SFL       | 312092 | 131.1   | 50-500       | 0.500          | 6       | 0.8             | 1.00    | В  | 0.5               |     | 62418          |
| Oskaloosa Lake      | 411385 | 12.5    | 5-50         | 0.100          | 4       | 0.8             | 1.00    | Α  | 1.0               |     | 32911          |
| Parsons Lake        | 84602  | 803.1   | 500-<br>1000 | 1.000          | 4       | 0.8             | 1.00    | Α  | 1.0               |     | 67682          |
| Perry Lake          | 357757 | 10587.6 | >1000        | 2.000          | 3       | 1.0             | 1.00    | Α  | 1.0               |     | 715514         |
| Pomona Lake         | 292313 | 3720.9  | >1000        | 2.000          | 5       | 0.8             | 1.00    | Α  | 1.0               | Х   | 467701         |
| Pottawatomie Co.    |        |         |              |                |         |                 |         |    |                   |     |                |
| SFL #2              | 115674 | 70.2    | 50-500       | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 28919          |
| Prairie Lake        | 96519  | 61.3    | 50-500       | 0.500          | 4       | 0.8             | 1.00    | Α  | 1.0               |     | 38608          |
| Shawnee Co. SFL     | 222703 | 121.5   | 50-500       | 0.500          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 55676          |
| Shawnee Mission     |        |         |              |                |         |                 |         |    |                   |     |                |
| Lake                | 797476 | 115.5   | 50-500       | 0.500          | 13      | 0.6             | 1.00    | Α  | 1.0               |     | 239243         |
| Strowbridge         |        |         |              |                |         |                 |         |    |                   |     |                |
| Reservoir           | 313569 | 241.1   | 50-500       | 0.500          | 5       | 0.8             | 1.00    | В  | 0.5               | Χ   | 62714          |
| Toronto Lake        | 39413  | 2476.0  | >1000        | 2.000          | 3       | 1.0             | 1.00    | Α  | 1.0               |     | 78826          |
| Tuttle Creek Lake   | 120588 | 11987.0 | >1000        | 2.000          | 2       | 1.0             | 1.00    | Α  | 1.0               |     | 241176         |
| Wabaunsee Co.       |        |         |              |                |         |                 |         |    |                   |     |                |
| Lake                | 143131 | 207.2   | 50-500       | 0.500          | 2       | 1.0             | 1.00    | Α  | 1.0               | Χ   | 71566          |

| Lake<br>Name          | Pop_30         | Acres   | Size<br>Class    | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | æ | Contact<br>Factor | PWS | Final<br>Score |
|-----------------------|----------------|---------|------------------|----------------|---------|-----------------|---------|---|-------------------|-----|----------------|
| Waconda Lake          | 18075          | 10050.0 | >1000            | 2.000          | 1       | 1.0             | 1.00    | Α | 1.0               | Х   | 36150          |
| Webster Lake          | 13063          | 1337.9  | >1000            | 2.000          | 2       | 1.0             | 1.00    | Α | 1.0               |     | 26126          |
| Wellington Lake       | 149226         | 384.8   | 50-500           | 0.500          | 3       | 1.0             | 1.00    | Α | 1.0               | Χ   | 74613          |
| Wellington New        |                |         |                  |                |         |                 |         |   |                   |     |                |
| City Lake             | 120188         | 206.3   | 50-500           | 0.500          | 3       | 1.0             | 1.00    | Α | 1.0               | Χ   | 60094          |
| Wilson Lake           | 19430          | 7760.8  | >1000            | 2.000          | 1       | 1.0             | 1.00    | Α | 1.0               |     | 38860          |
| Winfield City Lake    | 162563         | 1041.3  | >1000            | 2.000          | 2       | 1.0             | 1.00    | Α | 1.0               |     | 325126         |
| Wolf Creek Lake       | 63817          | 4983.9  | >1000            | 2.000          | 3       | 1.0             | 1.00    | В | 0.5               |     | 63817          |
| Wyandotte Co. Lake    | 744936         | 323.0   | 50-500           | 0.500          | 6       | 8.0             | 1.00    | Α | 1.0               |     | 297974         |
| Yates Center          |                |         |                  |                |         |                 |         |   |                   |     |                |
| Reservoir             | 49547          | 112.8   | 50-500           | 0.500          | 3       | 1.0             | 1.00    | Α | 1.0               | Χ   | 24774          |
| Alma City Lake        | 152934         | 24.5    | 5-50             | 0.100          | 2       | 1.0             | 1.00    | В | 0.5               | Χ   | 7647           |
| Altamont City Main    |                |         |                  |                |         |                 |         |   |                   |     |                |
| Lake (#1)             | 73347          | 21.3    | 5-50             | 0.100          | 4       | 0.8             | 1.00    | В | 0.5               |     | 2934           |
| Altamont City West    | 72247          | 11.0    | F F0             | 0.400          |         | 0.0             | 4.00    | _ | 0.5               |     | 2024           |
| Lake (#3)             | 73347          | 11.0    | 5-50             | 0.100          | 4       | 0.8             | 1.00    | В | 0.5               |     | 2934           |
| Antelope Lake         | 10724          | 1.6     | 1-5              | 0.010          | 2       | 1.0             | 1.00    | В | 0.5               |     | 54             |
| Anthony City Lake     | 16874          | 113.2   | 50-500           | 0.500          | 1       | 1.0             | 1.00    | Α | 1.0               |     | 8437           |
| Antioch Park Lake     | 712904         | 2.4     | 1-5              | 0.010          | 8       | 0.6             | 1.00    | Α | 1.0               |     | 4277           |
| Atchison Co. Park     | E0120          | 70.7    | EO EOO           | 0.500          | 3       | 1.0             | 1 00    | В | 0.5               |     | 14520          |
| Lake Atchison Co. SFL | 58120<br>89512 | 61.0    | 50-500<br>50-500 | 0.500          | 2       | 1.0             | 1.00    | В | 0.5               |     | 14530          |
| Atwood Township       | 09312          | 01.0    | 30-300           | 0.500          |         | 1.0             | 1.00    | D | 0.5               |     | 22378          |
| Lake                  | 9400           | 39.6    | 5-50             | 0.100          | 1       | 1.0             | 1.00    | В | 0.5               |     | 470            |
| Barber Co. SFL        | 19820          | 44.1    | 5-50             | 0.100          | 1       | 1.0             | 1.00    | В | 0.5               |     | 991            |
| Bartlett City Lake    | 71317          | 15.9    | 5-50             | 0.100          | 5       | 0.8             | 1.00    | В | 0.5               |     | 2853           |
| Barton Lake           | 44053          | 13.6    | 5-50             | 0.100          | 3       | 1.0             | 1.00    | а | 0.1               |     | 441            |
| Belleville City Lake  | 17370          | 18.3    | 5-50             | 0.100          | 1       | 1.0             | 1.00    | В | 0.5               |     | 869            |
| Beymer Lake           | 53364          | 4.9     | 1-5              | 0.010          | 1       | 1.0             | 1.00    | A | 1.0               |     | 534            |
| Big Creek Oxbow       | 40730          | 3.0     | 1-5              | 0.010          | 1       | 1.0             | 1.00    | В | 0.5               |     | 204            |
| Big Eleven Lake       | 680789         | 3.4     | 1-5              | 0.010          | 5       | 0.8             | 1.00    | В | 0.5               |     | 2723           |
| Blue Mound City       | 000703         | 3.1     |                  | 0.010          |         | 0.0             | 1.00    |   | 0.5               |     | 2723           |
| Lake                  | 55737          | 21.3    | 5-50             | 0.100          | 3       | 1.0             | 1.00    | В | 0.5               |     | 2787           |
| Bourbon Co. SFL       | 61420          | 92.0    | 50-500           | 0.500          | 2       | 1.0             | 1.00    | В | 0.5               |     | 15355          |
| Boy Scout Lake        | 37943          | 4.2     | 1-5              | 0.010          | 3       | 1.0             | 1.00    | Α | 1.0               |     | 379            |
| Bronson City Lake     | 60865          | 13.7    | 5-50             | 0.100          | 3       | 1.0             | 1.00    | В | 0.5               |     | 3043           |
| Brown Co. SFL         | 41704          | 69.1    | 50-500           | 0.500          | 2       | 1.0             | 1.00    | В | 0.5               |     | 10426          |
| Buffalo Park Lake     | 544397         | 11.9    | 5-50             | 0.100          | 8       | 0.6             | 1.00    | В | 0.5               |     | 16332          |
| Caney City Lake       | 48681          | 64.7    | 50-500           | 0.500          | 1       | 1.0             | 1.00    | В | 0.5               |     | 12170          |
| Carbondale West       |                |         |                  |                |         |                 |         |   |                   |     |                |
| Lake                  | 311608         | 7.1     | 5-50             | 0.100          | 6       | 0.8             | 1.00    | В | 0.5               |     | 12464          |

| Lake<br>Name        | Pop_30 | Acres | Size Class | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | CR | Contact<br>Factor | PWS | Final<br>Score |
|---------------------|--------|-------|------------|----------------|---------|-----------------|---------|----|-------------------|-----|----------------|
| Cedar Creek         |        |       |            |                |         |                 |         |    |                   |     |                |
| Reservoir           | 52918  | 198.5 | 50-500     | 0.500          | 6       | 0.8             | 1.00    | В  | 0.5               |     | 10584          |
| Cedar Crest Lake    | 297115 | 2.6   | 1-5        | 0.010          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 891            |
| Central Park Lake   | 306380 | 1.3   | 1-5        | 0.010          | 12      | 0.6             | 1.00    | В  | 0.5               |     | 919            |
| Centralia Lake      | 34278  | 232.9 | 50-500     | 0.500          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 17139          |
| Chanute Santa Fe    |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                | 66349  | 73.4  | 50-500     | 0.500          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 16587          |
| Chisholm Creek Park |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                | 553034 | 2.7   | 1-5        | 0.010          | 9       | 0.6             | 1.00    | В  | 0.5               |     | 1659           |
| Cimarron Lake (Moss |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake Middle)        | 9837   | 1.1   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 49             |
| Circle Lake         | 47404  | 21.7  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 2370           |
| Clark Co. SFL       | 35045  | 292.5 | 50-500     | 0.500          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 8761           |
| Colby City Lake     | 13208  | 1.6   | 1-5        | 0.010          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 66             |
| Concannon SFL       | 46289  | 13.4  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 2314           |
| Cowley Co. SFL      | 41133  | 77.1  | 50-500     | 0.500          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 10283          |
| Crystal Lake        | 70301  | 13.8  | 5-50       | 0.100          | 4       | 0.8             | 1.00    | В  | 0.5               |     | 2812           |
| Dillon Park Lakes   | 133976 | 2.9   | 1-5        | 0.010          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 670            |
| Dornwood Park Lake  | 314838 | 0.0   | <1         | 0.001          | 12      | 0.6             | 1.00    | В  | 0.5               |     | 94             |
| Eagle Lake (BelAire |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake)               | 552268 | 4.6   | 1-5        | 0.010          | 9       | 0.6             | 1.00    | В  | 0.5               |     | 1657           |
| Edna City Lake      | 61240  | 11.8  | 5-50       | 0.100          | 4       | 0.8             | 1.00    | Α  | 1.0               |     | 4899           |
| Elkhorn Lake        | 120243 | 4.4   | 1-5        | 0.010          | 4       | 0.8             | 1.00    | В  | 0.5               |     | 481            |
| Ellis City Lake     | 35480  | 8.6   | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 1774           |
| Elm Creek Lake      | 66006  | 78.5  | 50-500     | 0.500          | 8       | 0.6             | 1.00    | Α  | 1.0               |     | 19802          |
| Empire Lake         | 55092  | 416.4 | 50-500     | 0.500          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 13773          |
| Eureka Lake         | 21111  | 251.3 | 50-500     | 0.500          | 2       | 1.0             | 1.00    | Α  | 1.0               | Χ   | 10556          |
| Finney Co. SFL/W.A. | 20521  | 5.0   | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 1026           |
| Ford Co. Lake       | 40554  | 15.2  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 2028           |
| Fossil Lake         | 39866  | 42.2  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 1993           |
| Francis Wachs W.A.  | 9717   | 7.7   | 5-50       | 0.100          | 1       | 1.0             | 1.00    | а  | 0.1               |     | 97             |
| Frisco Lake         | 846692 | 3.4   | 1-5        | 0.010          | 16      | 0.6             | 1.00    | В  | 0.5               |     | 2540           |
| Gage Park Lake      | 301669 | 2.8   | 1-5        | 0.010          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 905            |
| Garnett North Lake  | 74584  | 44.1  | 5-50       | 0.100          | 4       | 0.8             | 1.00    | Α  | 1.0               | Х   | 5967           |
| Goodman SFL         | 7777   | 23.5  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 389            |
| Gridley City Lake   | 59484  | 33.7  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 5948           |
| Gunn Park East Lake | 52215  | 2.6   | 1-5        | 0.010          | 6       | 0.8             | 1.00    | В  | 0.5               |     | 209            |
| Gunn Park West      |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                | 52215  | 6.3   | 5-50       | 0.100          | 6       | 0.8             | 1.00    | В  | 0.5               |     | 2089           |
| Hain SFL            | 39804  | 27.5  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 1990           |
| Hamilton Co. SFL    | 7000   | 43.8  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 350            |
| Harrison Park Lake  | 525905 | 2.2   | 1-5        | 0.010          | 8       | 0.6             | 1.00    | В  | 0.5               |     | 1578           |

| Lake<br>Name          | Pop_30 | Acres | Size Class | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | CR | Contact<br>Factor | PWS | Final<br>Score |
|-----------------------|--------|-------|------------|----------------|---------|-----------------|---------|----|-------------------|-----|----------------|
| Harvey Co. Camp       |        |       |            |                |         |                 |         |    |                   |     |                |
| Hawk Lake             | 516016 | 3.6   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | Α  | 1.0               |     | 5160           |
| Harveyville Lake      | 225876 | 17.1  | 5-50       | 0.100          | 1       | 1.0             | 0.01    | Α  | 1.0               |     | 226            |
| Herington City Park   |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                  | 61958  | 2.0   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 310            |
| Hiawatha City Lake    | 45520  | 7.1   | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 2276           |
| Hillsboro City Lake   | 73989  | 0.6   | <1         | 0.001          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 37             |
| Hodgeman Co.          |        |       |            |                |         |                 |         |    |                   |     |                |
| SFL/W.A.              | 37843  | 251.2 | 50-500     | 0.500          | 3       | 1.0             | 1.00    |    | 0.0               |     | 0              |
| Hole In The Rock      | 416361 | 0.1   | <1         | 0.001          | 4       | 0.8             | 1.00    | В  | 0.5               |     | 167            |
| Horseshoe Lake        | 545822 | 11.0  | 5-50       | 0.100          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 16375          |
| Horsethief Canyon     |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                  | 37943  | 450.0 | 50-500     | 0.500          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 18972          |
| Jerry's Lake          | 625499 | 1.0   | 1-5        | 0.010          | 4       | 8.0             | 1.00    | В  | 0.5               |     | 2502           |
| Jetmore Lake          | 37582  | 30.9  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | Α  | 1.0               |     | 3758           |
| Jewell Co. SFL        | 18382  | 39.2  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 919            |
| Jones Park Lake       | 54297  | 1.2   | 1-5        | 0.010          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 271            |
| Kid's Lake            | 545822 | 9.6   | 5-50       | 0.100          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 16375          |
| Kingman Co. SFL       | 32787  | 125.0 | 50-500     | 0.500          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 8197           |
| Kiowa Co. SFL         | 13954  | 20.1  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 698            |
| KWP Hatchery and      |        |       |            |                |         |                 |         |    |                   |     |                |
| Ponds                 | 23156  | 80.5  | 50-500     | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 5789           |
| La Claire Lake        | 62827  | 6.4   | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 3141           |
| Lake Charles          | 40878  | 1.4   | 1-5        | 0.010          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 204            |
| Lake Coldwater        | 8547   | 231.1 | 50-500     | 0.500          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 4274           |
| Lake Dabanawa         | 575103 | 77.8  | 50-500     | 0.500          | 4       | 0.8             | 0.01    | Α  | 1.0               |     | 2300           |
| Lake Idlewild         | 24899  | 6.1   | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 1245           |
| Lake Jayhawk          | 390956 | 19.7  | 5-50       | 0.100          | 4       | 0.8             | 0.01    | Α  | 1.0               |     | 313            |
| Lake Jewell           | 18382  | 57.0  | 50-500     | 0.500          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 9191           |
| Lake Jivaro           | 321526 | 73.2  | 50-500     | 0.500          | 6       | 0.8             | 0.01    | Α  | 1.0               |     | 1286           |
| Lake Kahola           | 50283  | 359.0 | 50-500     | 0.500          | 1       | 1.0             | 0.01    | Α  | 1.0               |     | 251            |
| Lake Meade State      |        |       |            |                |         |                 |         |    |                   |     |                |
| Park                  | 26648  | 66.2  | 50-500     | 0.500          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 13324          |
| Lake Quivera          | 786119 | 159.5 | 50-500     | 0.500          | 10      | 0.6             | 0.01    | Α  | 1.0               | Х   | 2358           |
| Lake Scott State Park | 11895  | 108.6 | 50-500     | 0.500          | 1       | 1.0             | 1.00    | Α  | 1.0               |     | 5948           |
| Lake Sherwood         | 286615 | 239.9 | 50-500     | 0.500          | 11      | 0.6             | 0.01    | Α  | 1.0               |     | 860            |
| Lake Tanko            |        |       |            |                |         |                 |         |    |                   |     |                |
| (Cherryvale City      |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake)                 | 83475  | 15.4  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 4174           |
| Lake Warnock          |        |       |            |                |         |                 |         |    |                   |     |                |
| (Atchison City Lake)  | 102602 | 33.0  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | Α  | 1.0               |     | 10260          |

| Lake<br>Name        | Pop_30 | Acres | Size Class | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | CR | Contact<br>Factor<br>PWS | Final |
|---------------------|--------|-------|------------|----------------|---------|-----------------|---------|----|--------------------------|-------|
| Lakeview Estates    |        |       |            |                |         |                 |         |    |                          |       |
| Lake                | 293903 | 16.9  | 5-50       | 0.100          | 11      | 0.6             | 0.01    | В  | 0.5                      | 88    |
| Lakewood Park Lake  | 80197  | 10.9  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5                      | 4010  |
| Lansing City Lake   | 756118 | 2.9   | 1-5        | 0.010          | 5       | 0.8             | 1.00    | В  | 0.5                      | 3024  |
| Lebo City Park Lake | 64185  | 2.3   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5                      | 321   |
| Lemon Park Lake     | 22434  | 1.9   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5                      | 112   |
| Leonard's Lake      | 45999  | 7.4   | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5                      | 2300  |
| Little Lake         | 53889  | 9.3   | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5                      | 2694  |
| Logan City Lake     | 16653  | 8.0   | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5                      | 833   |
| Logan Co. SFL       | 5751   | 44.3  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5                      | 288   |
| Lyndon City Lake    | 127546 | 56.2  | 50-500     | 0.500          | 4       | 8.0             | 0.01    | В  | 0.5                      | 255   |
| Lyon Co. SFL        | 68250  | 128.5 | 50-500     | 0.500          | 1       | 1.0             | 1.00    | В  | 0.5                      | 17063 |
| Mahaffie Farmstead  |        |       |            |                |         |                 |         |    |                          |       |
| Lake                | 784664 | 1.3   | 1-5        | 0.010          | 12      | 0.6             | 1.00    | В  | 0.5                      | 2354  |
| Mallard Lake (Moss  |        |       |            |                |         |                 |         |    |                          |       |
| Lake East)          | 11365  | 0.5   | <1         | 0.001          | 3       | 1.0             | 1.00    | В  | 0.5                      | 6     |
| Mary's Lake         | 724098 | 4.2   | 1-5        | 0.010          | 4       | 0.8             | 1.00    | В  | 0.5                      | 2896  |
| McPherson Co. SFL   | 110756 | 39.9  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5                      | 5538  |
| Memorial Park Lake  | 43200  | 12.7  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5                      | 2160  |
| Merrit Lake         | 463067 | 5.5   | 5-50       | 0.100          | 4       | 8.0             | 1.00    | В  | 0.5                      | 18523 |
| Mined Land Lake 01  | 71174  | 3.1   | 1-5        | 0.010          | 10      | 0.6             | 1.00    | В  | 0.5                      | 214   |
| Mined Land Lake 02  | 71384  | 1.6   | 1-5        | 0.010          | 10      | 0.6             | 1.00    | а  | 0.1                      | 43    |
| Mined Land Lake 03  | 70818  | 0.5   | <1         | 0.001          | 10      | 0.6             | 1.00    | В  | 0.5                      | 21    |
| Mined Land Lake 04  | 70818  | 10.2  | 5-50       | 0.100          | 10      | 0.6             | 1.00    | В  | 0.5                      | 2125  |
| Mined Land Lake 05  | 89393  | 6.3   | 5-50       | 0.100          | 12      | 0.6             | 1.00    | В  | 0.5                      | 2682  |
| Mined Land Lake 06  | 89393  | 6.8   | 5-50       | 0.100          | 12      | 0.6             | 1.00    | В  | 0.5                      | 2682  |
| Mined Land Lake 07  | 84357  | 12.5  | 5-50       | 0.100          | 17      | 0.4             | 1.00    | В  | 0.5                      | 1687  |
| Mined Land Lake 08  | 82348  | 11.3  | 5-50       | 0.100          | 18      | 0.4             | 1.00    | В  | 0.5                      | 1647  |
| Mined Land Lake 09  | 80138  | 8.4   | 5-50       | 0.100          | 24      | 0.4             | 1.00    | В  | 0.5                      | 1603  |
| Mined Land Lake 10  | 82093  | 1.0   | 1-5        | 0.010          | 25      | 0.4             | 1.00    | В  | 0.5                      | 164   |
| Mined Land Lake 11  | 83477  | 5.8   | 5-50       | 0.100          | 30      | 0.4             | 1.00    | В  | 0.5                      | 1670  |
| Mined Land Lake 12  | 82093  | 16.0  | 5-50       | 0.100          | 28      | 0.4             | 1.00    | В  | 0.5                      | 1642  |
| Mined Land Lake 13  | 82093  | 4.6   | 1-5        | 0.010          | 26      | 0.4             | 1.00    | В  | 0.5                      | 164   |
| Mined Land Lake 14  | 82093  | 7.9   | 5-50       | 0.100          | 26      | 0.4             | 1.00    | В  | 0.5                      | 1642  |
| Mined Land Lake 15  | 82093  | 13.6  | 5-50       | 0.100          | 24      | 0.4             | 1.00    | В  | 0.5                      | 1642  |
| Mined Land Lake 17  | 86726  | 17.3  | 5-50       | 0.100          | 36      | 0.4             | 1.00    | В  | 0.5                      | 1735  |
| Mined Land Lake 18  | 86333  | 13.7  | 5-50       | 0.100          | 36      | 0.4             | 1.00    | В  | 0.5                      | 1727  |
| Mined Land Lake 19  | 85712  | 15.0  | 5-50       | 0.100          | 35      | 0.4             | 1.00    | В  | 0.5                      | 1714  |
| Mined Land Lake 20  | 89283  | 16.9  | 5-50       | 0.100          | 32      | 0.4             | 1.00    | В  | 0.5                      | 1786  |
| Mined Land Lake 21  | 88129  | 15.1  | 5-50       | 0.100          | 34      | 0.4             | 1.00    | В  | 0.5                      | 1763  |
| Mined Land Lake 22  | 86889  | 22.2  | 5-50       | 0.100          | 31      | 0.4             | 1.00    | В  | 0.5                      | 1738  |

| Lake<br>Name             | Pop_30 | Acres | Size Class | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | CR | Contact<br>Factor | PWS | Final<br>Score |
|--------------------------|--------|-------|------------|----------------|---------|-----------------|---------|----|-------------------|-----|----------------|
| Mined Land Lake 23       | 88129  | 31.6  | 5-50       | 0.100          | 34      | 0.4             | 1.00    | В  | 0.5               |     | 1763           |
| Mined Land Lake 24       | 88910  | 35.0  | 5-50       | 0.100          | 28      | 0.4             | 1.00    | В  | 0.5               |     | 1778           |
| Mined Land Lake 25       | 88296  | 9.9   | 5-50       | 0.100          | 26      | 0.4             | 1.00    | В  | 0.5               |     | 1766           |
| Mined Land Lake 26       | 84491  | 9.5   | 5-50       | 0.100          | 24      | 0.4             | 1.00    | В  | 0.5               |     | 1690           |
| Mined Land Lake 27       | 89166  | 32.7  | 5-50       | 0.100          | 28      | 0.4             | 1.00    | В  | 0.5               |     | 1783           |
| Mined Land Lake 28       | 88910  | 0.5   | <1         | 0.001          | 28      | 0.4             | 1.00    | а  | 0.1               |     | 4              |
| Mined Land Lake 29       | 88910  | 12.2  | 5-50       | 0.100          | 29      | 0.4             | 1.00    | В  | 0.5               |     | 1778           |
| Mined Land Lake 30       | 90064  | 30.6  | 5-50       | 0.100          | 28      | 0.4             | 1.00    | В  | 0.5               |     | 1801           |
| Mined Land Lake 31       | 86889  | 61.5  | 50-500     | 0.500          | 31      | 0.4             | 1.00    | В  | 0.5               |     | 8689           |
| Mined Land Lake 32       | 86889  | 14.2  | 5-50       | 0.100          | 34      | 0.4             | 1.00    | В  | 0.5               |     | 1738           |
| Mined Land Lake 33       | 90064  | 42.9  | 5-50       | 0.100          | 28      | 0.4             | 1.00    | В  | 0.5               |     | 1801           |
| Mined Land Lake 34       | 90064  | 32.7  | 5-50       | 0.100          | 28      | 0.4             | 1.00    | В  | 0.5               |     | 1801           |
| Mined Land Lake 35       | 88910  | 27.9  | 5-50       | 0.100          | 29      | 0.4             | 1.00    | В  | 0.5               |     | 1778           |
| Mined Land Lake 36       | 90812  | 20.8  | 5-50       | 0.100          | 28      | 0.4             | 1.00    | В  | 0.5               |     | 1816           |
| Mined Land Lake 37       | 86333  | 3.9   | 1-5        | 0.010          | 36      | 0.4             | 1.00    | В  | 0.5               |     | 173            |
| Mined Land Lake 38       | 86333  | 6.1   | 5-50       | 0.100          | 36      | 0.4             | 1.00    | В  | 0.5               |     | 1727           |
| Mined Land Lake 39       | 89283  | 14.3  | 5-50       | 0.100          | 34      | 0.4             | 1.00    | В  | 0.5               |     | 1786           |
| Mined Land Lake 40       | 88129  | 16.9  | 5-50       | 0.100          | 34      | 0.4             | 1.00    | В  | 0.5               |     | 1763           |
| Mined Land Lake 41       | 87495  | 41.8  | 5-50       | 0.100          | 36      | 0.4             | 1.00    | В  | 0.5               |     | 1750           |
| Mined Land Lake 42       | 86333  | 11.9  | 5-50       | 0.100          | 36      | 0.4             | 1.00    | В  | 0.5               |     | 1727           |
| Mined Land Lake 43       | 86333  | 9.9   | 5-50       | 0.100          | 36      | 0.4             | 1.00    | В  | 0.5               |     | 1727           |
| Mined Land Lake 44       | 86333  | 77.2  | 50-500     | 0.500          | 36      | 0.4             | 1.00    | В  | 0.5               |     | 8633           |
| Mined Land Lake 45       | 86333  | 47.5  | 5-50       | 0.100          | 35      | 0.4             | 1.00    | В  | 0.5               |     | 1727           |
| Mingenback Lake          | 140443 | 3.2   | 1-5        | 0.010          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 702            |
| Moline City #1           |        |       |            |                |         |                 |         |    |                   |     |                |
| (Santa Fe Lake)          | 17924  | 12.9  | 5-50       | 0.100          | 4       | 8.0             | 1.00    | Α  | 1.0               |     | 1434           |
| Moline City Lake #2      | 15945  | 25.0  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               | Х   | 797            |
| Moline Reservoir         | 21124  | 160.9 | 50-500     | 0.500          | 4       | 0.8             | 1.00    | Α  | 1.0               |     | 8450           |
| Montgomery Co. SFL       | 67401  | 85.4  | 50-500     | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 16850          |
| Moss Lake                | 545822 | 13.6  | 5-50       | 0.100          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 16375          |
| Mound City Lake          | 49818  | 122.9 | 50-500     | 0.500          | 4       | 0.8             | 1.00    | В  | 0.5               |     | 9964           |
| Murray Gill Lake         | 32540  | 401.6 | 50-500     | 0.500          | 3       | 1.0             | 1.00    | Α  | 1.0               |     | 16270          |
| Myer's Lake              | 319862 | 13.1  | 5-50       | 0.100          | 10      | 0.6             | 1.00    | В  | 0.5               |     | 9596           |
| Nebo SFL                 | 160582 | 30.0  | 5-50       | 0.100          | 4       | 0.8             | 1.00    | В  | 0.5               |     | 6423           |
| Neosho Co. SFL           | 92321  | 56.6  | 50-500     | 0.500          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 23080          |
| Neosho Falls City        |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                     | 47404  | 1.7   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 237            |
| New Strawn Park          |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                     | 70143  | 3.0   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 351            |
| New Yates Center<br>Lake | 49996  | 168.0 | 50-500     | 0.500          | 5       | 0.8             | 1.00    | В  | 0.5               |     | 9999           |

| Lake<br>Name         | Pop_30 | Acres | Size Class | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | CR | Contact<br>Factor | PWS | Final<br>Score |
|----------------------|--------|-------|------------|----------------|---------|-----------------|---------|----|-------------------|-----|----------------|
| Newton City Park     |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                 | 470621 | 34.2  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 23531          |
| North Park Lake      | 795260 | 2.3   | 1-5        | 0.010          | 5       | 8.0             | 1.00    | В  | 0.5               |     | 3181           |
| Norton Lake          |        |       | 500-       |                |         |                 |         |    |                   |     |                |
| (Sebelius Lake)      | 11357  | 782.4 | 1000       | 1.000          | 1       | 1.0             | 1.00    | Α  | 1.0               | Χ   | 11357          |
| Ogden City Lake      | 125126 | 13.7  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | Α  | 1.0               |     | 12513          |
| Olathe Waterworks    |        |       |            |                |         |                 |         |    |                   |     |                |
| Lakes                | 779776 | 9.8   | 5-50       | 0.100          | 12      | 0.6             | 1.00    | В  | 0.5               |     | 23393          |
| Osawatomie City      |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                 | 242417 | 24.5  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 12121          |
| Otis Creek Lake      |        |       |            |                |         |                 |         |    |                   |     |                |
| (Eureka)             | 31373  | 240.1 | 50-500     | 0.500          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 7843           |
| Ottawa Co. SFL       | 74729  | 95.3  | 50-500     | 0.500          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 18682          |
| Overbrook Lake       | 321788 | 6.0   | 5-50       | 0.100          | 7       | 0.6             | 1.00    | В  | 0.5               |     | 9654           |
| Paola City Lake      | 501558 | 23.9  | 5-50       | 0.100          | 4       | 0.8             | 1.00    | В  | 0.5               |     | 20062          |
| Parker City Lake     | 68429  | 7.5   | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 3421           |
| Peter Pan Lake       | 55838  | 2.8   | 1-5        | 0.010          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 279            |
| Pierson Park Lake    | 722265 | 11.4  | 5-50       | 0.100          | 9       | 0.6             | 1.00    | В  | 0.5               |     | 21668          |
| Pittsburg College    |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                 | 70254  | 2.1   | 1-5        | 0.010          | 12      | 0.6             | 1.00    | В  | 0.5               |     | 211            |
| Plainville Township  |        |       |            |                |         |                 |         |    |                   |     |                |
| Lake                 | 34838  | 23.5  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 1742           |
| Playter's Lake       | 74794  | 3.8   | 1-5        | 0.010          | 12      | 0.6             | 1.00    | В  | 0.5               |     | 224            |
| Pleasanton City Lake |        |       |            |                |         |                 |         |    |                   |     |                |
| #1                   | 47058  | 24.4  | 5-50       | 0.100          | 5       | 8.0             | 1.00    | В  | 0.5               | Χ   | 1882           |
| Pleasanton City Lake |        |       |            |                | _       |                 |         | _  |                   |     |                |
| #2                   | 47058  | 15.3  | 5-50       | 0.100          | 5       | 8.0             | 1.00    | В  | 0.5               | Х   | 1882           |
| Pleasanton Reservoir | 45226  | 100.1 | 50-500     | 0.500          | 4       | 8.0             | 1.00    | Α  | 1.0               | Χ   | 18090          |
| Point of Rocks Lake  |        |       |            |                |         |                 |         |    |                   |     |                |
| (Moss Lake West)     | 4369   | 1.0   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 22             |
| Polk Daniels Lake    | 24540  | 64.0  | 50 500     | 0.500          |         | 4.0             | 4.00    |    | 0.5               |     | 6420           |
| (Elk Co. SFL)        | 24510  | 64.8  | 50-500     | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 6128           |
| Pony Creek Lake      | 25509  | 103.6 | 50-500     | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 6377           |
| Pottawatomie Co.     | 02446  | 47.2  | F F0       | 0.400          | 4       | 4.0             | 1.00    | _  | 0.5               |     | 4657           |
| SFL #1               | 93146  | 17.3  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 4657           |
| Potter's Lake        | 667491 | 1.2   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 3337           |
| Pratt Co. Lake       | 23156  | 46.4  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 1158           |
| Prescott City Lake   | 27862  | 16.6  | 5-50       | 0.100          | 4       | 8.0             | 1.00    | В  | 0.5               |     | 1114           |
| Quarry Lake          | 45414  | 16.9  | 5-50       | 0.100          | 4       | 8.0             | 1.00    | В  | 0.5               |     | 1817           |
| Richmond City Lake   | 76745  | 12.7  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 3837           |
| Riggs Park Lake      | 523717 | 1.2   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5               | Χ   | 2619           |
| Rimrock Park Lake    | 124316 | 2.5   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 622            |

| Lake<br>Name              | Pop_30 | Acres | Size Class | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | CR | Contact<br>Factor | PWS | Final |
|---------------------------|--------|-------|------------|----------------|---------|-----------------|---------|----|-------------------|-----|-------|
| Rock Creek Lake           | 57709  | 52.8  | 50-500     | 0.500          | 6       | 0.8             | 1.00    | В  | 0.5               |     | 11542 |
| Rocky Ford W.A.           | 120579 | 7.7   | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 6029  |
| Rooks Co. SFL             | 14433  | 28.4  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 722   |
| Rose's Lake               | 788410 | 2.3   | 1-5        | 0.010          | 13      | 0.6             | 1.00    | В  | 0.5               |     | 2365  |
| Sabetha City Lake         | 26388  | 105.9 | 50-500     | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               | Χ   | 6597  |
| Sabetha Watershed         |        |       |            |                |         |                 |         |    |                   |     |       |
| Lake (Niehues)            | 31775  | 0.3   | <1         | 0.001          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 16    |
| Saline Co. SFL            | 81073  | 21.9  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 4054  |
| Scranton City Lake        | 306324 | 10.3  | 5-50       | 0.100          | 6       | 0.8             | 1.00    | В  | 0.5               |     | 12253 |
| Sedan City North          |        |       |            |                |         |                 |         |    |                   |     |       |
| Lake                      | 29588  | 40.2  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 1479  |
| Sedan City South          |        |       |            |                |         |                 |         |    |                   |     |       |
| Lake                      | 29588  | 64.2  | 50-500     | 0.500          | 3       | 1.0             | 1.00    | Α  | 1.0               |     | 14794 |
| Severy City Lake          | 21892  | 11.6  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               | Χ   | 1095  |
| Sheridan Co. SFL          | 8681   | 43.4  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 434   |
| Smith Lake                | 463048 | 3.4   | 1-5        | 0.010          | 4       | 0.8             | 1.00    | В  | 0.5               |     | 1852  |
| Smoky Hill Garden         |        |       |            |                |         |                 |         |    |                   |     |       |
| Lake                      | 8509   | 12.7  | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 425   |
| South Lake Park           | 705078 | 6.0   | 5-50       | 0.100          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 21152 |
| Spring Creek Park         |        |       |            |                |         |                 |         |    |                   |     |       |
| Lake                      | 519850 | 11.3  | 5-50       | 0.100          | 4       | 8.0             | 1.00    | В  | 0.5               |     | 20794 |
| Spring Hill City Lake     | 768642 | 33.3  | 5-50       | 0.100          | 10      | 0.6             | 1.00    | В  | 0.5               |     | 23059 |
| St. Jacobs Well (Big      |        |       |            |                |         |                 |         | _  |                   |     |       |
| Basin W.A.)               | 8562   | 15.0  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 428   |
| Sterling City Lake        | 85980  | 8.3   | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 4299  |
| Stohl Park Lake           | 763134 | 1.6   | 1-5        | 0.010          | 12      | 0.6             | 1.00    | В  | 0.5               |     | 2289  |
| Stone Lake                | 45526  | 37.4  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 2276  |
| Sunflower Park Lake       | 829896 | 1.4   | 1-5        | 0.010          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 4149  |
| Thayer New City           |        |       |            |                | _       |                 |         | _  |                   |     |       |
| Lake                      | 71381  | 16.8  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | В  | 0.5               |     | 3569  |
| Thayer Old City Lake      | 70838  | 23.5  | 5-50       | 0.100          | 3       | 1.0             | 1.00    | A  | 1.0               |     | 7084  |
| Timber Lake               | 68236  | 20.6  | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 3412  |
| Topeka Public Golf        | 205004 | 2.2   | 4.5        | 0.040          | 40      | 0.6             | 1.00    | -  | 0.5               |     | 055   |
| Course Lake               | 285001 | 3.3   | 1-5        | 0.010          | 10      | 0.6             | 1.00    | В  | 0.5               |     | 855   |
| Troy Fair Lake            | 37607  | 5.1   | 5-50       | 0.100          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 1880  |
| Vic's Lake                | 545822 | 11.4  | 5-50       | 0.100          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 16375 |
| Wamego City Lake          | 109648 | 0.8   | <1         | 0.001          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 55    |
| Warren Park Lake          | 304134 | 0.2   | <1         | 0.001          | 12      | 0.6             | 1.00    | В  | 0.5               |     | 91    |
| Washburn Rural            |        |       |            |                |         |                 |         |    |                   |     |       |
| Environmental Lab<br>Lake | 300128 | 3.7   | 1-5        | 0.010          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 900   |
| Washington Co. SFL        | 18735  | 77.8  | 50-500     | 0.500          | 1       | 1.0             | 1.00    | В  | 0.5               |     | 4684  |

| Lake<br>Name         | Pop_30 | Acres | Size Class | Size<br>Factor | Lake_30 | Lakes<br>Factor | Private | CR | Contact<br>Factor | PWS | Final<br>Score |
|----------------------|--------|-------|------------|----------------|---------|-----------------|---------|----|-------------------|-----|----------------|
| Watson Park Lake     | 555774 | 21.1  | 5-50       | 0.100          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 16673          |
| Wilson Co. SFL       | 50955  | 109.4 | 50-500     | 0.500          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 12739          |
| Windmill Lake        | 547874 | 17.4  | 5-50       | 0.100          | 11      | 0.6             | 1.00    | В  | 0.5               |     | 16436          |
| Winfield Park Lagoon | 123647 | 6.1   | 5-50       | 0.100          | 2       | 1.0             | 1.00    | В  | 0.5               |     | 6182           |
| Woodson Co. SFL      | 51694  | 112.5 | 50-500     | 0.500          | 5       | 0.8             | 1.00    | В  | 0.5               |     | 10339          |
| Xenia Lake           | 50005  | 65.5  | 50-500     | 0.500          | 3       | 1.0             | 1.00    | В  | 0.5               | Χ   | 12501          |

### APPENDIX L

## Standard Operating Procedures for HAB Data Management System

| Procedure   | Last Revised |
|---|--------------|
| The Survey Web Application (DM-001)                 | 03/30/19     |
| Oracle Harmful Algal Bloom Database System (DM-002) | 03/30/19     |
| KDHE Harmful Algae Bloom Management System (DM-003) | 03/30/19     |

# THE SURVEY WEB APPLICATION (DM-001)

The Survey Web Application is the public facing web interface to the KDHE's complaint tracking system, <a href="http://www.kdheks.gov/algae-illness/index.htm">http://www.kdheks.gov/algae-illness/index.htm</a>. It has three distinct entry forms:

- **1)** Algal Bloom complaint <a href="https://survey123.arcgis.com/share/5b5aeea4205c411d97cbeb173a5d6d96">https://survey123.arcgis.com/share/5b5aeea4205c411d97cbeb173a5d6d96</a>
- **2)** Human Health complaint <a href="https://kdheks.co1.qualtrics.com/jfe/form/SV\_6G7KaEywuwGtsBD">https://kdheks.co1.qualtrics.com/jfe/form/SV\_6G7KaEywuwGtsBD</a> and
- 3) Animal Health complaint

https://kdheks.co1.qualtrics.com/jfe/form/SV\_3m9Zfcls27nckMB

The algal complaint form is routed simultaneously to environmental staff in BOW and BEFS and queued into the HAB Tracking System. The human and animal health complaints are simultaneously routed to staff in BEPHI. Complaints are responded to by the respective staff.

- 1. Algal bloom complaints are received into the HAB Tracking System, where they will be reviewed by BOW-WPMAS staff to determine whether the complaint is valid and whether the waterbody is a "public" lake and/or a Public Drinking water supply source.
- 2. Human and Animal health complaints are reviewed by the BEPHI staff to determine if the illness is associated with HAB exposure. The BEPHI staff is required to enter the environmentally relevant portion of the complaint information (no Protected Health information) into the algal bloom component to initiate the investigation.

Technical Note: The Survey Web Applications are built within KDHE ArcGIS Online Organizational account. They were built by Office of Information Technology GIS Staff using Desktop ESRI Survey123 Connect Application. The data from the Survey is written into the KDHE Oracle GIS Schema, which is then consumed by the Harmful Algal Bloom Tracking System (Oracle APEX application). Verification of the Survey is the first step in the HAB Management System.

Oracle Harmful Algal Bloom DATABASE System

#### (DM-002)

- I. A critical component of the HAB Management System, which is required by the HAB Tracking System, are two other Oracle databases. The two other Oracle databases are updated through separate applications:
  - A. The Surface Water Site ID System. The locations of all sites sampled for any water quality parameter are entered into this database. This geospatial database gives the geographic location of the sites, names, and other fields explained below. A site not existing in the system needs to be entered prior to associating/entering any data. (Oracle Table: GIS.HYDRO\_BOW\_MON\_POINT)
  - **B. The Algae Database**. This contains cell counts for several individual cyanobacteria taxa as well as for diatoms, dinoflagellates, crytophytes, euglenophytes, and other algae. It also contains calculated metrics (percent cell counts) and percent biomass counts for these. In addition, it contains results from toxin analysis. Data must be hadn entered into this database before the HAB Tracking System can evaluate recommended advisory status for a given waterbody. (Oracle Table: BEFS ADMIN.ALGAE)

Both databases are used by the monitoring networks outside of the HAB system. The procedures to enter both databases are as follows:

#### A. Surface Water Site ID System

In order to enter HAB data into KDHE's Oracle database, first a Surface Water Site has to be created in Oracle Forms for the HAB site. If a header already exists for the site then proceed to **B**.

1. Logon to Oracle has to be authorized by IT:

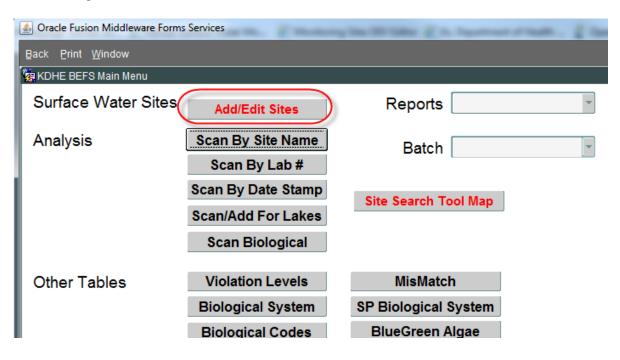
http://kdhenet/KDHEoracle\_apps\_gallery.htm



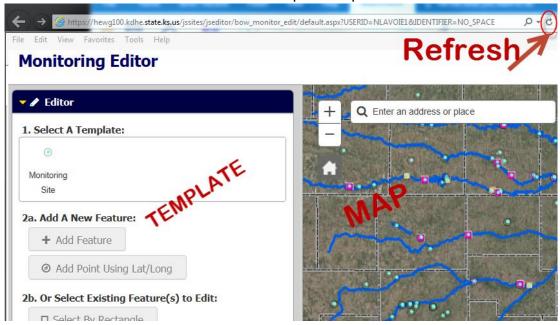
Surface Water Quality Analysis

... (oraforms\SC\SCMAINMENU.fmx)

2. Log onto Oracle, and click on 'Add/Edit Sites' to add HAB site header:



- 3. This will open a Web Map Editor in which to add the new Site Header.
  - \*\*NOTE: If you receive a 404 web page not found error, please request your name be added to the approved Web Map Editing. This is a separate security layer for editing in the map.
  - \*\* Click Refresh on the browser if the map or template doesn't draw first time.



1. Select A Template:

Monitoring

Site

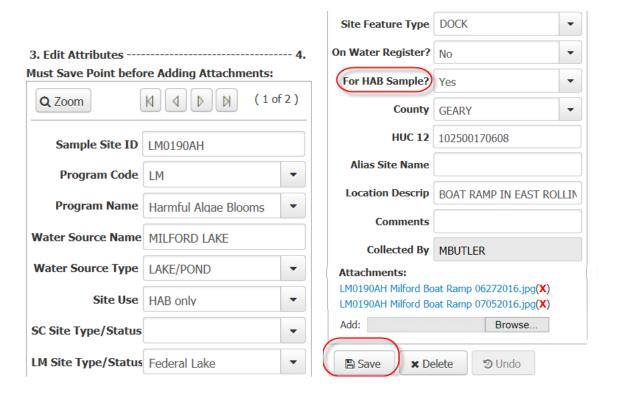
- 4. Add the Point Using one of the following methods:
  - 1. Click on the "Select A Template" Monitoring Site to make it active
  - **2. A.** Zoom in on the map to location ...



- Click on the map to add the point or
- B. If you already have Lat/Long from GPS or other source ...



- 3. Enter required minimum information (the site name will be decided by HAB group) on screen:
- \*\* MUST HAVE HAB SAMPLE? "YES" for it to draw in the HAB web maps.
- \*\* Attachements can be added only <u>after</u> a NEW point is saved and the map Refreshed.
- \*\* HUC 12 and County Labels should be drawing in the map (or turn the layer on)



4. A Green box will appear in the upper right hand when the Point is added or updated. Click the Refresh button if you need to add attachements.



#### **Algae Database**

Generating Data: After performing taxonomic identifications and absolute cell counts, the algal taxonomist uses a stand alone MSExcel software spreadsheet with built in macros (described in the KDHE Lake and Wetland Monitoring Program's Quality Assurance Management Plan; see "Form LW-5") to calculate derived metrics such as percent bluegreens, percent greens, and biovolumes. Toxin analysis results and chlorophyll-a analysis results may also be entered into this same spreadsheet.

**Entering Data:** Once there is a header for the Sample Site, the actual data can be entered into Oracle's Algae database; again, logon needs to be authorized by IT.

1. Logon to Oracle has to be authorized by IT:

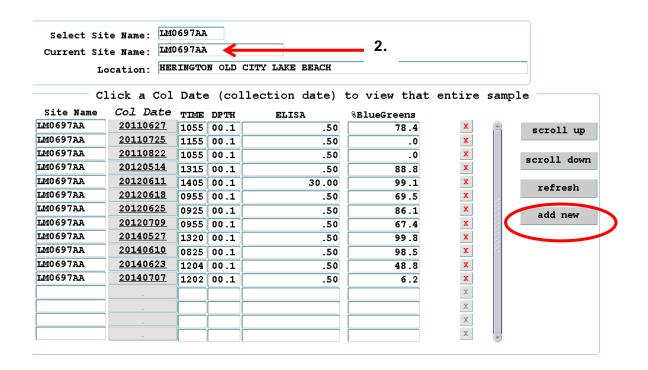
http://kdhenet/KDHEoracle\_apps\_gallery.htm



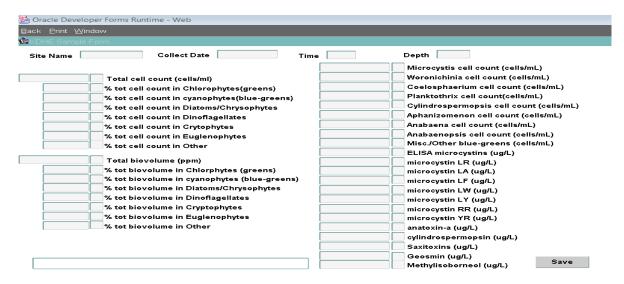
Surface Water Quality Analysis

... (oraforms\SC\SCMAINMENU.fmx)

- 2. Type in 'Site Name' and hit 'Enter'
- 3. Click on 'Add New'



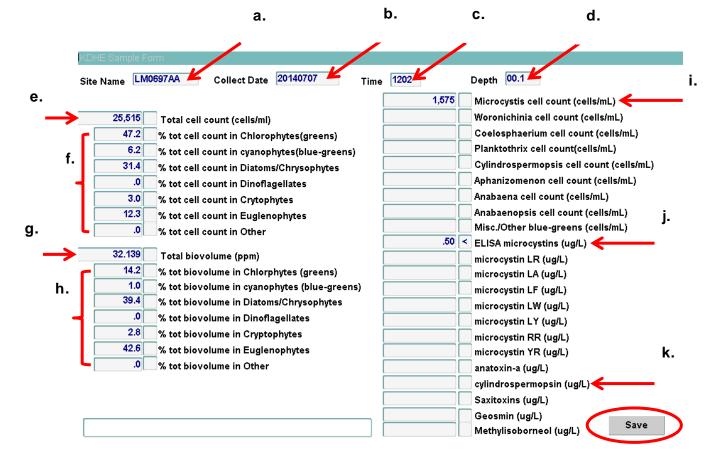
4. This will bring up a blank page to which the new information for the site can be added.



From the lab sheets, obtain the following information to be entered:

- a. Site Name (Required)
- **b.** Collection Date (Required)
- c. Time sample was collected (Required)
- d. Depth of sample (Depth is 00.1 m for all algal data, required field)

- e. Total cell count
- f. % Greens, Blue-greens, etc.
- g. Total biovolume
- h. % total biovolume in greens, blue-greens, etc.
- i. Microcystis cell count
- j. ELISA Microcystins
- **k.** Cylindrospermopsin (if required)
- I. Click on 'Save' when finished



The data can be retrieved from the Algae database located in Oracle/Environment. The algal data on Oracle is automatically linked to the KDHE Harmful Algae Bloom Management System application, where it can be viewed/downloaded.

REFERENCE: KDHE 2017. Division of Environment, Quality Management Plan Part III: Lake and Wetland Monitoring Program (Revision 5), 103 pp.

# KDHE HARMFUL ALGAE BLOOM MANAGEMENT SYSTEM PROCEDURE (DM-003)

#### Summary

The HAB Tracking System receives complaints from the public-facing, online reporting form system. If a HAB complaint arrives via email or phone call, BOW-WMPAS staff initiate the process by submitting a complaint form on behalf of the individual who called or emailed.

Next, we determine whether the HAB complaint is valid. For example, if a member of the public enters a complaint for a private pond, we will mark the complaint as "invalid" and may contact the individual to redirect them elsewhere for assistance. Or, the complaint may not contain convincing evidence that a full scale analysis is warranted (*e.g.*, there is a photograph of slightly green water, but it's difficult to tell whether it represents a HAB event). In the latter case, BOW-WPMAS staff may request additional evidence (in the form of a jar test) from the complainant or the lake manager.

If the complaint is considered valid, the HAB sampling procedure will be initiated. The event nomenclature for the HAB Tracking Application is for an individual waterbody to receive a "Request," which is then followed by a "Task" for each sampling event. As long as a lake is in an active bloom, only one "Request" is required. Once a sampling task has been initiated, it must go through the whole process (from issuing the sampling task to changing the status of the "Request" based on the sampled data) before another sampling task can be issued. The "Request" will disappear only when the advisory status for that waterbody is updated to "Below Watch." In general, the user must keep in mind that the HAB Tracking Application has minimal error trapping and is not equipped to deal with typos or discrepancies between records. For example, if sample stations are labeled incorrectly in the Algal Database, or if times/dates do not match, then the record won't be imported into the HAB Tracking Application. Make sure that dates and times are entered in the correct format, etc.

Most operations will occur in the "Business Processes" Menu, in the upper right-hand corner of the main screen.

Business Processes

Validate Complaints

Determine Complaint Validity

Issue New Request

Update Request Complaints

Sample Site/Lake Management

Task Management

Add Sample Site Photos

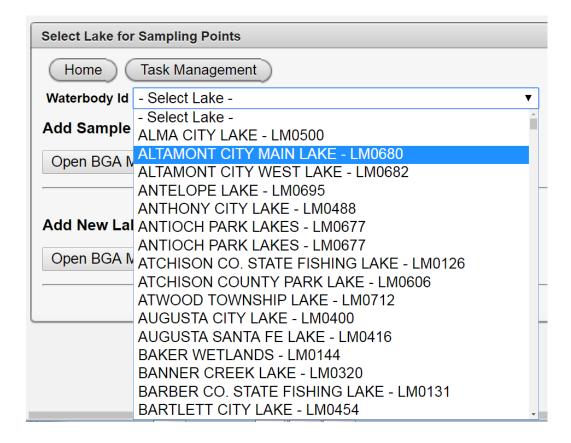
Change Request Status

Status Notification

After a HAB complaint is received:

#### Step 1: Check to see if the lake has an assigned number

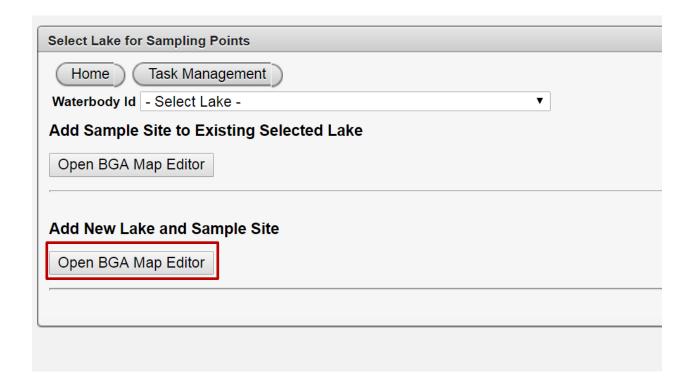
Before starting the process, it is helpful to make sure that the lake in question has a lake number and HAB sample locations- this can be verified directly in Oracle ENVI, or through the *Sample Site/Lake Management* screen. (\*NOTE- if the "Sample Site / Lake Management screen is blank, computer support staff will need to give permissions for access). All lakes with a number assigned in Oracle will appear in the dropdown menu, even if they've never been sampled for HABs. All zoned lakes will have the nomenclature "LM(zone letter)(lake number without leading 0)." For example, Perry Lake Zone A is: LMA290. If the given lake does not appear in the dropdown list, proceed to the next step to add a lake to the HAB tracking system.



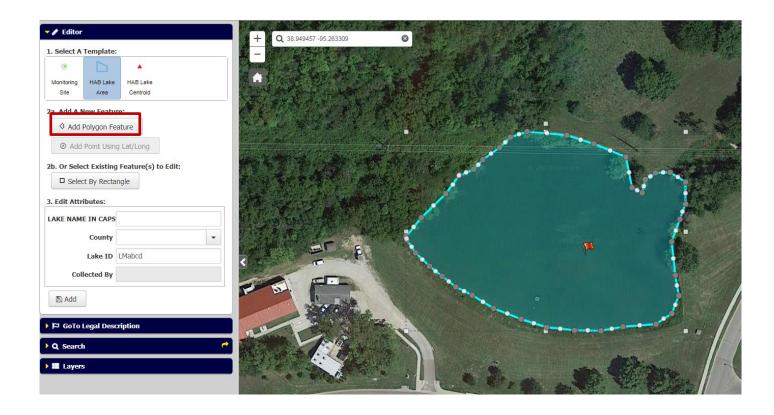
#### Step 1.1 Adding a lake to the system

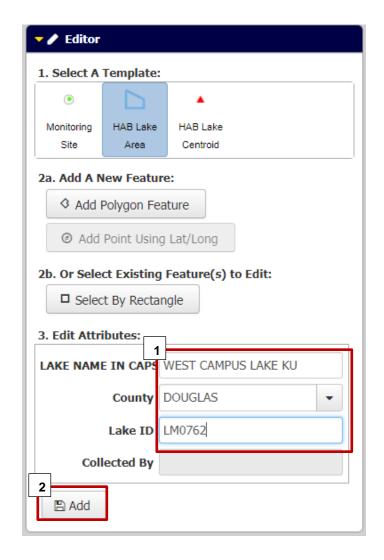
Before assigning a number to a lake, it is important to check with the Lake and Wetland Monitoring Program Staff, who are responsible for assigning them. This ensures that numbers are neither skipped nor duplicated.

Once a new lake number is established, open the *Sample Site/Lake Management* screen. Underneath "Add New Lake and Sample Site," click on the "Open BGA Map Editor" button.



Navigate to the lake location with the search bar and select "Add Polygon Feature." Outline the lake's shape, then fill in the fields below "Edit Attributes."

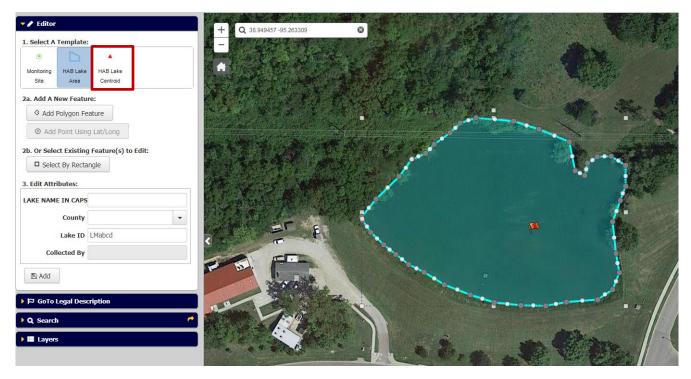




Select the "Add" button. The words "Feature added!" will appear on the map if everything worked correctly.

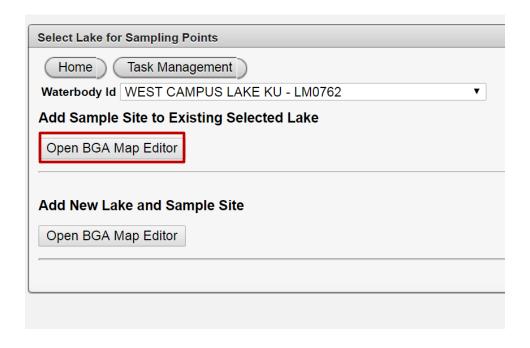
#### Step 1.2 Adding a centroid to the lake

After creating the lake outline, add a "centroid" to the lake. Select "HAB Lake Centroid" in the same "Add Polygon Feature" screen. The centroid needs to be placed somewhere in the middle of the lake polygon, but it does not have to be the exact center. The coordinates are used for lake location mapping.



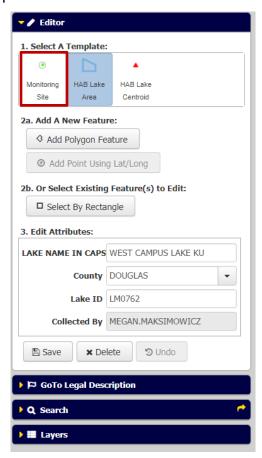
Step 2: Check to see if there are HAB sample sites

If a new lake number was required, it has not been sampled for HABs before. However, if the lake was already in the system, check to see whether it has been sampled for HABs before. As soon as the lake has a number in Oracle, it will be visible in the *Sample Site/Lake Management* (under the "Business Processes" menu). Select the lake, click on "Open BGA Map Editor," and wait for the map to appear; it may take a few seconds. The map will have all sample locations marked. All HAB recreation sample sites are designated by the convention "AA," "AB," "AC," and so on. All HAB PWS sample sites are designated by the convention "BA," "BB," and so on. If the lake has a site designated, go on to Step 3: Validate visual description of complaint.

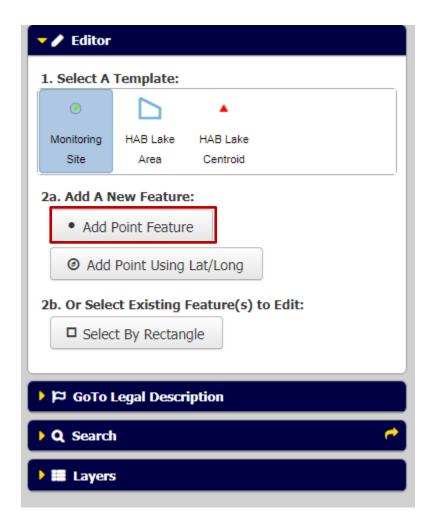


Step 2.1: Adding a HAB sample site

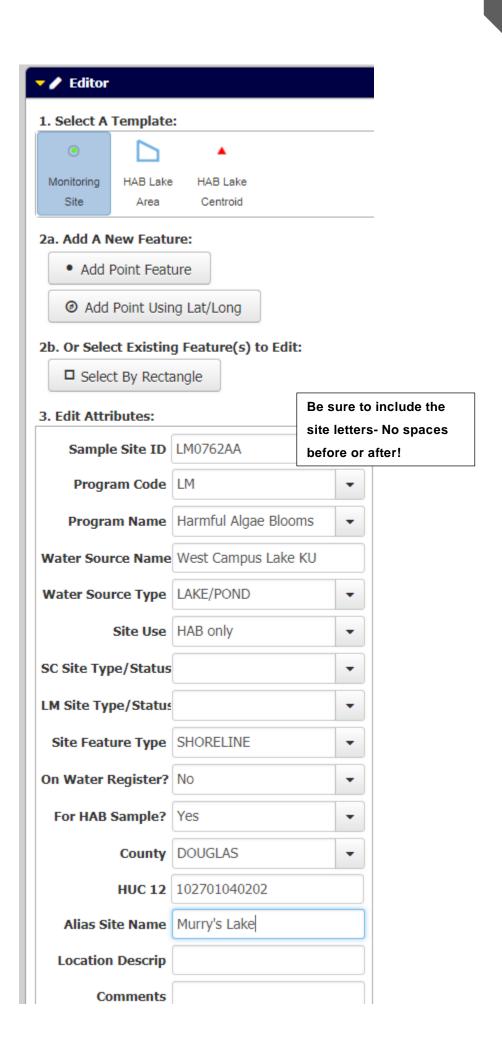
Open a map of the lake in the *Sample Site/Lake Management* screen. Click on "Monitoring Site" under "1. Select a Template" on the left-hand side.



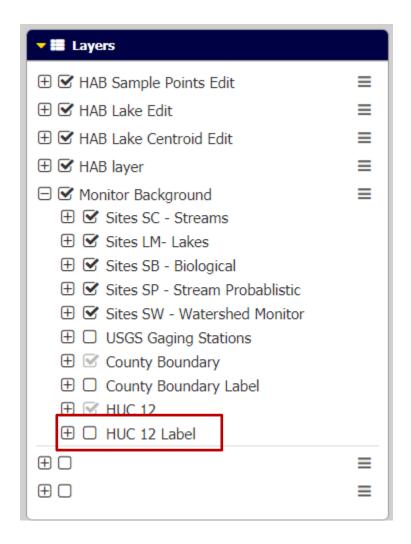
The menu will change. Select "Add Point Feature," unless measured coordinates (latitude and longitude) are available.



Select the sample site location on the map (based on primary contact locations, *e.g.*, a swim beach – discuss with HAB group first).



Fill out the attributes for that specific location. The HUC 12 label can be found on the "Monitor Background" dropdown, under the "Layers" dropdown, located at the very bottom of the editor toolbar.



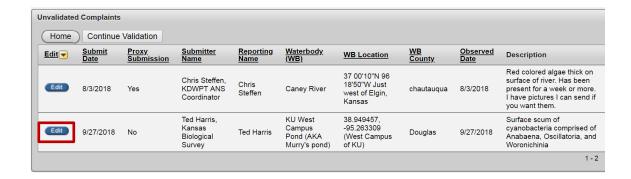
When all the attributes are entered, click on the "Add" button at the bottom of the attributes box. When a sample site is successfully added, it will appear on the map with the words "Feature Added!"

#### Step 3.1: Validate visual description of complaint.

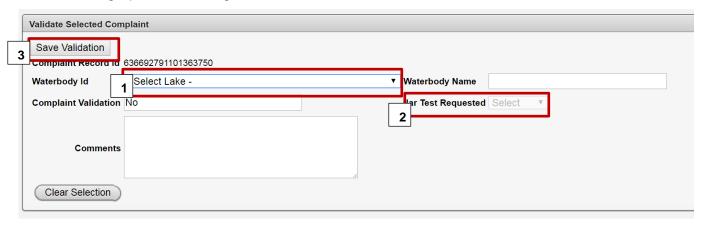
There are two components to validation of a complaint. The first component is based on narrative description or a visual, and the second component is if further validation is required using the jar test method. If a complaint is received by a lake manager or other professional who have a good working knowledge of HAB, it is often advanced in the system without a request for further data. The jar test validation is most often used in cases where the

reliability of the complainant is unknown or it is difficult to tell, from field photographs, if a cynanobactieral bloom is present. Both components must be completed in the HAB Tracking Application to fully validate a complaint.

For the first validation, select *Validate Complaints* under the Business Processes Menu. Select "Edit" for the complaint in question.



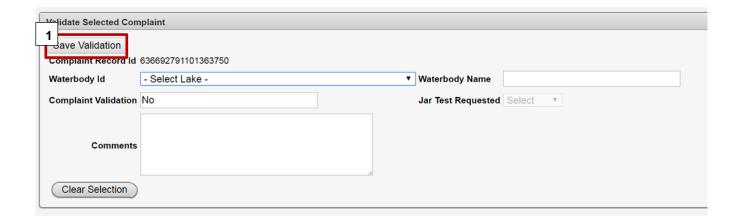
This will bring up the following menu:



First, select "Waterbody Id" from the dropdown menu. This will change the "Complaint Validation" section to say "Yes," and the "Jar Test Requested" dropdown will then be active. Select "Yes" or "No" for the Jar Test Requested, depending on whether one is required. This will send out an email to the HAB Team listserv that there has or has not been a jar test requested, so it is helpful to add comments here - (Example: If a jar test has already come in, the user can say "Yes" for the request, but add a comment to specify that the test has actually been completed already, and results were already submitted.)

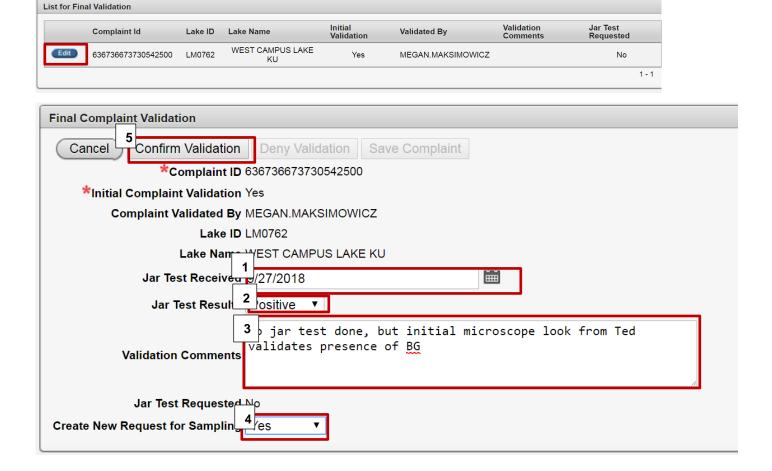
Step 3.2: Invalidate Complaint

Alternatively, if the complaint is not valid, select "Save Validation" and do not fill out any other information. This will mark the complaint as invalid, and it will not appear again.



Step 4: Validate Jar Test

After the initial visual validation is saved, the complaint will now appear under **Determine Complaint Validity**, on the Business Processes menu. Again, select "Edit" for the complaint in question.



First, select the date using the calendar icon to the right of "Jar Test Received." Select a date, even if no actual jar test was done (for example, if the complaint was submitted by an experienced professional, and/or convincing photographic documentation was provided).

IMPORTANT: In order for the "Confirm validation" button to become active, the jar test results *must* be marked as "Positive." If no jar test was conducted, just enter an explanation under "Validation Comments."

Change the "Y" to "Yes" under "Create New Request for Sampling." Then select "Confirm Validation."

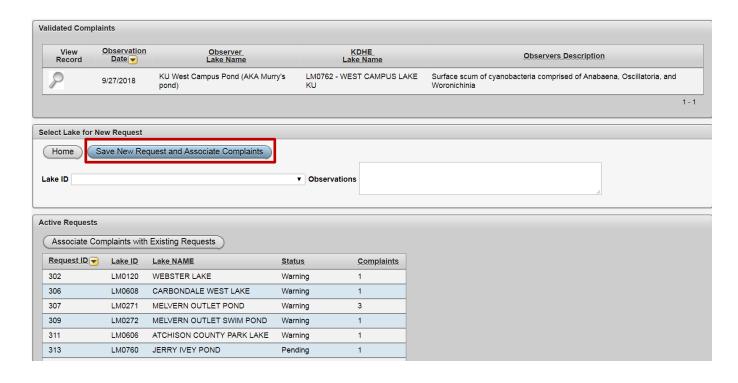
# Step 5: Use validated complaint to create a new request, or attach validated complaint to existing request

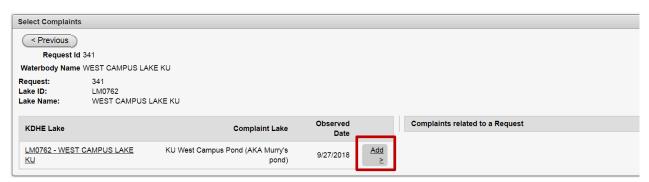
Once it has been determined that at least one sample will be needed from a given lake, the first task is to set up the "Request." This can be thought of as the way the application tracks the status of the whole lake. Once a Request has been opened, then "Tasks" can be assigned to sample. The waterbody-specific "Request" only needs to be initiated once for each active bloom, and that Request will then be updated with the waterbody's advisory status (*i.e.*, Watch, Warning, Below Watch) each time a sample is submitted.

To initiate the request, click on Issue **New Request** under the "Business Processes" menu. After the complaint has been validated for the jar test, it will appear under the "Validated Complaints" screen.

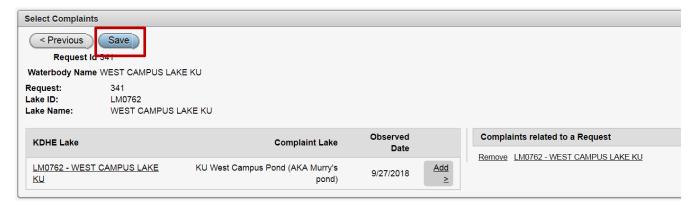
#### Step 5.1 (for a new request)

If this is the first Request for a lake, select the lake from the "Lake ID" dropdown menu (otherwise, please refer to Step 5.B for an existing request). After the lake is selected, click on the "Save New Request and Associate Complaints" button. All validated complaints will appear on the menu.





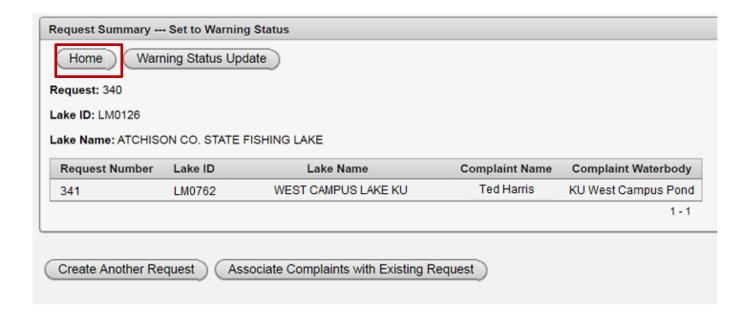
Select the "Add" button on the complaint that matches the given lake. This will populate the "Complaints related to a Request" column, and a "Save" button will appear.



Click "Save." This will send an email to the HAB Team listserv that a new sampling request has been issued.

Then a new screen will appear, with a button for "Home" and a button for "Warning Status Update." The "Warning Status Update" is for instances in which the HAB Team knows, based on professional reports or convincing photographic evidence, that the lake in question is already in the midst of an extreme bloom, and they wish to change the status without first sampling. This screen may also be used to "Create Another Request" for complaints for other lakes, or to "Associate Complaints with Existing Request" if there are multiple complaints for the same lake.

In most instances, just select the "Home" button, and move on to issuing a sampling task.



#### **Step 5.2 (for an existing request)**

If there is already an active request for a lake, it will not appear on the dropdown menu. Instead, select the "Associate Complaints with Existing Requests" button. This screen can also be accessed using the "Update Request Complaints" link on the Business Processes menu. Select the "Edit" button next to the lake with the complaint. This screen should have all of the available validated complaints to add to the request, but this may not be updated immediately. (Ask a coworker to login to double check this task under his/her login, if known complaints do not appear on this screen as expected.)

#### Step 6: Issue a sampling task

For all of the steps dealing with an individual sampling task, the user will keep returning to the *Task Management* link on the "Business Processes" screen. The menu will be separated into two sections – "Request with no task" and "Request with assigned tasks."

The new request will fall under the first section, "Request with no task." Note that if there are more than 15 records, the user may have to select the Next arrow at the bottom of the section to see more requests. They are not necessarily in alphabetical order.



Select the "Edit" button next to the lake where sampling is needed. Before completing this step, make sure that all of expected sampling locations exist in the "Sampling Site/Lake Management" map and are correctly labeled.

Selecting "Edit" will pull up the following screen.



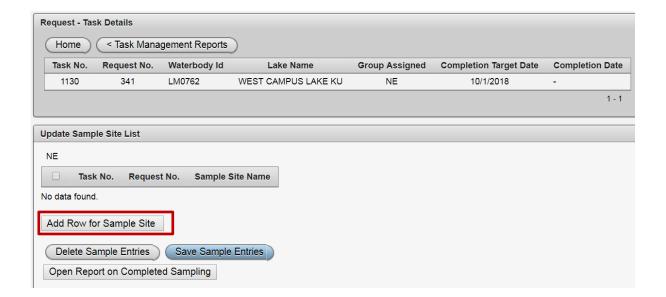
First, select from the dropdown menu which Field Unit will collect the sample. Field Unit can be determined using the District map located at: <a href="http://www.kdheks.gov/befs/dist\_office.html">http://www.kdheks.gov/befs/dist\_office.html</a>. Most lakes fall within one district's jurisdiction; however, some lakes require special treatment; consult the HAB Team manager if there is any question. Other monitoring crews

may sample when it falls into their regular sampling schedule, but for the most part, it will go to the District Office.

Next, select the calendar next to the "Fieldwork Due Date," and select the date (usually the Monday of the new sampling week).

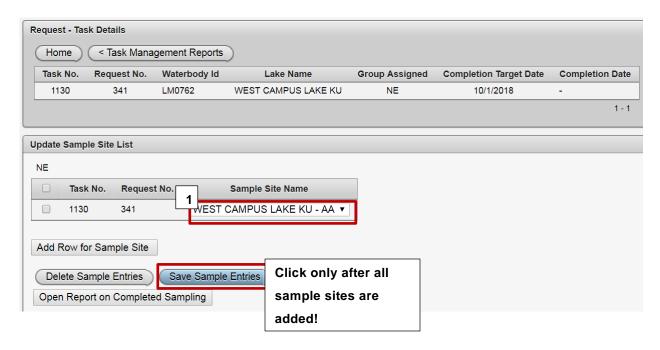
In the "Sampling Instructions" box, it is helpful to fill out any info for PWS sampling information, or to let District Offices know of any special information.

After this screen is complete, select the "Save Task" button.



This will pull up a new screen, which is only accessible after the "Save Task" button has been hit. This is why it's important to have the sampling site locations correct before this point. If they are incorrectly labeled or nonexistent, they will not be selectable at this time, and the sampling task will be irretrievable by the user; it cannot be advanced, deleted, or overwritten. If this happens, the user must contact computer support staff to delete the record, fix the sampling site error, and then resubmit the sampling task.

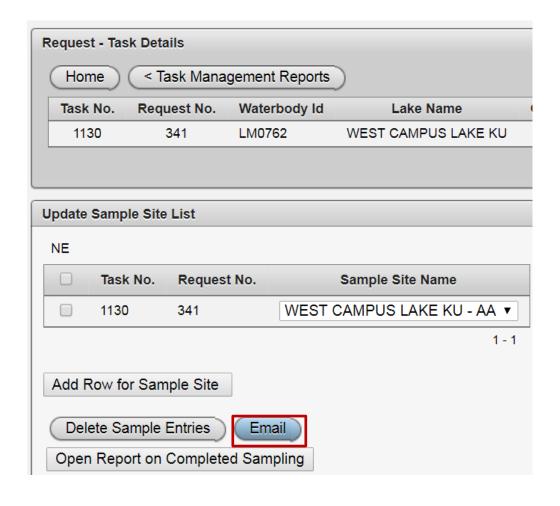
To add sampling sites, select the button for "Add Row for Sample Site."

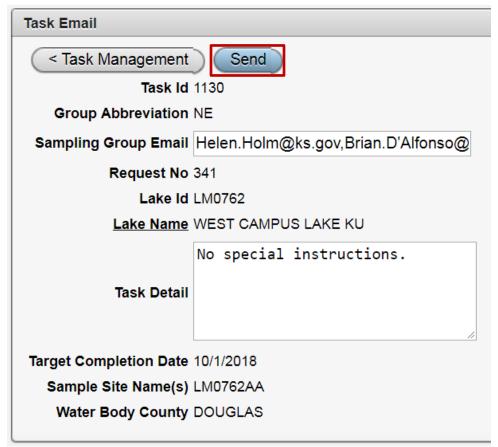


This will bring up a drop down menu, where one sampling site can be selected. Select sites from the dropdown menu. In smaller lakes, often only one sample is required, typically the "AA" site. If samples are needed from more than one location, add a row for each site using the "Add Row for Sample Site" button, and populate each row with a different site location.

When all of the sample site locations are selected, click on the "Save Sample Entries" button. The "Save Sample Entries" button will then be replaced with an "Email" button. Click on the Email button, which will automatically populate with the email addresses of the selected Field Unit\*, as well as any special instructions you've already filled out.

\*The email addresses can be updated/edited through the "Manage Sampling Crews" button under the "Application Administration" menu on the lower right of the main screen.





Click "Send." Now, wait until samples are received from the District Office or other sampling crew.

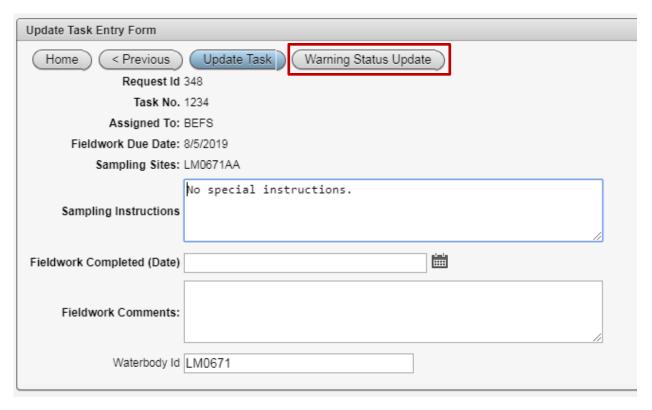
# Step 6.1 Update Request Status without Data

Occasionally after a sampling task has been submitted, we will need to update the status to a "Warning" level based on visual. Updating the status of the lake on the HAB tracking application will update the map of advisories to match our posted advisories listed on the website.

To update a request with a Warning after tasks have been assigned, select *Task Management* on the Business Processes menu.



Select "Edit" by the lake needing updated.



A new screen will appear with the "Warning Status Update" button available.

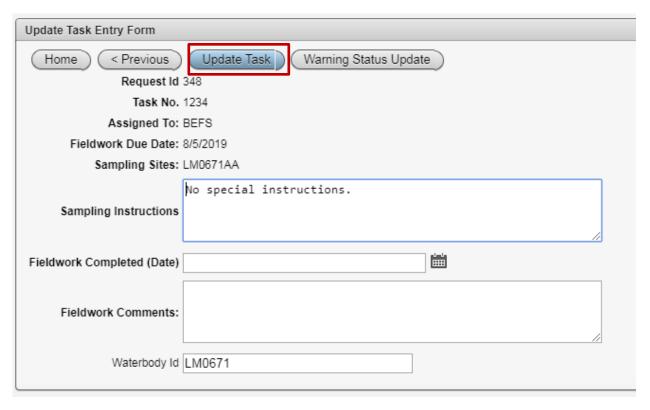
## Step 6.2 Correcting Sampling Sites After a Task Has Been Issued

If a correction to sampling sites needs to be made (i.e. site AA was flooded, so samples were retrieved at site AB instead), corrections can be made as follows:

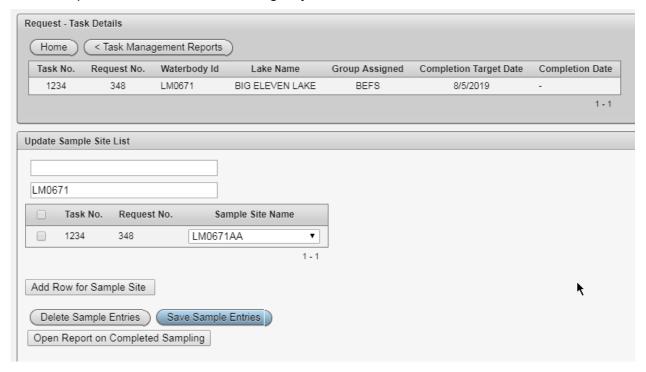
First, select *Task Management* on the Business Processes menu.



Select "Edit" by the lake needing updated.



Select "Update Task" without entering any other information.



Here, sites can be selected for deletion, while others can be added. Make any changes, then select "Save Sample Entries." You may need to exit the application or refresh the sampling task to see changes.

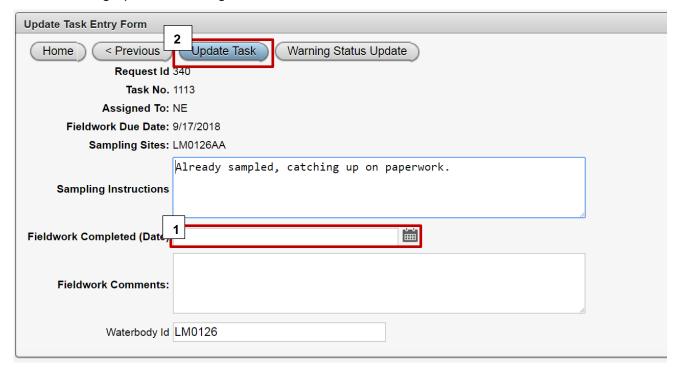
## Step 7: Update task with completion of fieldwork

Once the sample/s are received, click on *Task Management* under the Businesses Processes menu. The lake will appear on the lower menu entitled "Request with assigned tasks."



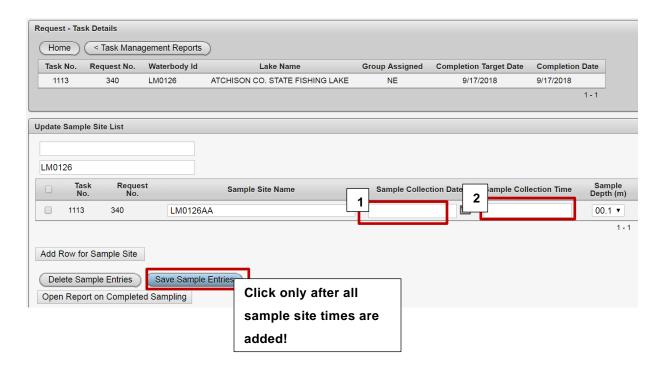
Once the sample results have been entered into the Algae Database by the analytical staff, select "Edit" next to the lake in question. It is possible to do this step before the sample results have been entered, but it is better to wait and double check the data entry with the entries in the Oracle Algae database. The data will be pulled in to the HAB Tracking Application as soon as a sample with the same sample name and time is entered into the Oracle database.

This will bring up the following screen:



Select the calendar next to "Fieldwork Completed (Date)," and select the date that fieldwork was completed. Then select "Update Task." (This is another location where the user can skip data, and simply select "Warning Status Update." This is rare, but useful to know in cases where the HAB Team staff are certain that the lake is in very bad condition, but haven't been able to test it yet.)

After "Update Task" is selected, the following screen will appear:



It is very important to get the sample date and time correct for each sample site. As soon as a sample with the same header information is entered into Oracle, the data will be imported into the HAB Tracking Application. Enter all times in military time, and with 4 digits (e.g., 0940 for 9:40 AM and 1340 for 1:40 PM). (Dates and times can easily be corrected in the Oracle Algae database, but they cannot be corrected in the HAB Tracking Application. If the user makes a data entry mistake here, computer support staff will have to delete the record so that date/time can be re-entered.

When this step is complete, click on the button for "Save Sample Entries."

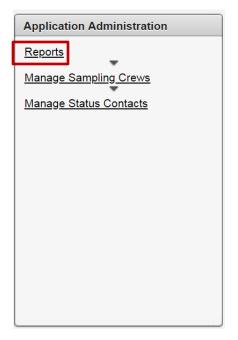
| Update Task Entry Form   |         |
|--|---------|
| Save and Complete Task   |         |
| Request Id 340   |         |
| <b>Task No.</b> 1113   |         |
| Assigned To: NE  |         |
| Fieldwork Due Date: 9/17/2018                                    |         |
| Sampling Instructions Already sampled, catching up on paperwork. |         |
| Fieldwork Completed (Date) 9/17/2018                             |         |
| Fieldwork Comments:  |         |
| Samples to Lab: 09/18/2018                                       | <b></b> |
|  |         |

A new screen appears, which automatically populates the "Samples to Lab" with the day after field work is complete. This date is not as consequential - it's not connected to data or other key components of the HAB Tracking Application. Click on the "Save and Complete Task" button. The request will no longer appear on the Task Management menus (either "Request with no task" or "Request with assigned tasks").

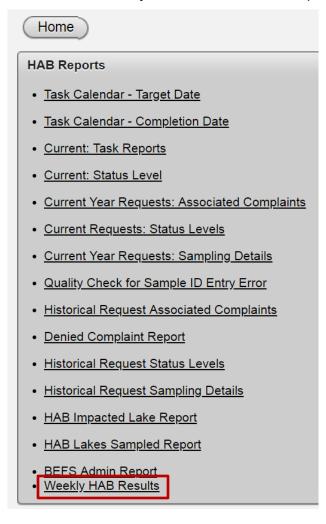
If the date, time, and sample site name match between Oracle and the HAB Tracking Application, then as soon as the data is entered in Oracle, it should be visible in the reports generated within the HAB Tracking Application.

#### Step 8: View data

This is one instance where we the desired screen is NOT accessed through the "Business Processes" menu. Instead, click on "Reports" under the *Application Administration* menu on the lower right of the main menu.



There are a variety of reports that are generated, but the one used to view the most recent data is the "Weekly HAB Results" at the very bottom of the HAB Reports screen.



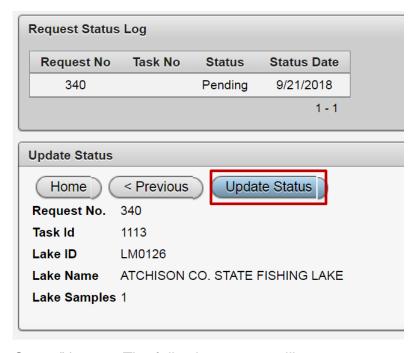
There are many ways to see the desired data. The user can filter through the "Actions" dropdown menu, or select "Date Collected" and click on the "Sort Descending" arrow. If the HAB Tracking Application correctly pulled information from Oracle, all dashes will be replaced by data.

## **Step 9: Update Request Status**

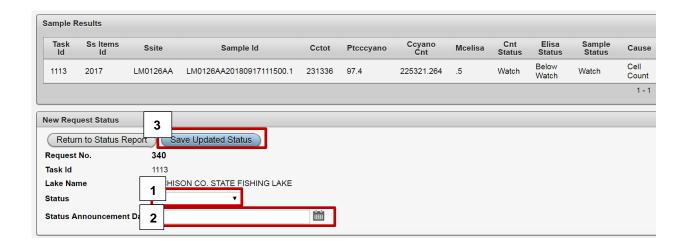
After viewing the data and conferring with the people in the weekly stakeholder meeting, update the request status. This can be done through the link to *Change Request Status* on the Business Processes menu. This will update the HAB map online, so make sure that this occurs immediately after the weekly stakeholder meeting.



All requests that have data will be available on this menu, along with the recommended status. Select the "Edit" button next to the lake in question. This will bring up the following screen:



Select the "Update Status" button. The following screen will appear:



The user can bypass the recommended status and select the agreed upon status under the "Status" dropdown menu. In most cases, the automatically recommended status is used. One example may be a case in which a credible report from a lake manager or District Staff member indicates that a bloom increased in severity greatly after the sampling date, so instead of the "Warning" that the data shows, the HAB Team may opt to use a visual confirmation to elevate to a "Closed" status. At any rate, all exceptions are to be discussed with stakeholders and supervisors first.

Use the calendar next to the "Status Announcement Date" field to select the date (usually the Thursday of the sampling week).

Then select the "Save Updated Status" button.

#### Step 10: Close a request or resample active HAB lakes

#### Step 10.1: Closing the request when a bloom has dissipated

If a request is changed to "Below Watch," it will no longer be an active request.\* This request is no longer considered "Active" and will not appear on the "Task Management" menus. If a bloom appears on the same waterbody later in the season, a new complaint will need to be validated, and a new request issued.

\*Note on zoned lakes: The HAB Team instituted the "Zone Below Watch" status to make sure that the requests for all of the zones stay active during a bloom. When the bloom is gone, all of the zones have a "Zone Below Watch" status. This does not trigger the HAB Tracking

Application to switch the Requests to inactive. The software does not currently have a mechanism to prevent this. When advisories have been lifted on all zones of a zoned lake, ask computer support staff to change the last status of all of the zones from "Zone Below Watch" to "Below Watch." This will switch the Request to inactive.

#### Step 10.2: Send out a task to resample HAB lakes

As soon as a Request is updated with a new advisory status, it will appear on the "Task Management > Request with no task" menu. When it is time to sample the lake again, start from "Step 6: Issue a sampling task" again, and create a sampling task. This process will repeat until the request is updated to "Below Watch" and is no longer considered active.

#### **Step 11: End of Season Protocol**

Requests that are active after the HAB season has ended should be closed out before the beginning of the following calendar year. The HAB tracking application resets at the beginning of the calendar year, so Requests must be updated manually in order to maintain proper record keeping.

To close a Request at the end of the HAB season:

- 1. Request a Sample to be done on 12-31
- 2. Enter in "0" for sample data on 12-31 in the Surface Water Quality Oracle Application
- 3. Enter in the sample data in the HAB Oracle App with the "0" sample data
- **4.** This allows you set the Request status as "Below Watch" on 12-31.
- **5.** If there is still an active bloom on the waterbody as of 12-31, issue a new complaint and Request for the waterbody.

**APPENDIX M** 

Acronyms

# Acronyms

BEFS Bureau of Environmental Field Services at KDHE

BEH Bureau of Environmental Health at KDHE

BEPHI Bureau of Epidemiology and Public Health Informatics at KDHE

BGA Blue Green Algae

BOW Bureau of Water at KDHE

CDC Centers for Disease Control and Prevention

DEA District Environmental Administrator (head of District office, BEFS)

ELISA Enzyme-Linked Immunosorbent Assay

GIS Geographic Information Systems

HA Health Advisories

**KSVDL** 

KDAH Kansas Department of Agriculture, Division of Animal Health

Kansas State Veterinary Diagnostic Laboratory

KDHE Kansas Department of Health and Environment

KDWPT Kansas Department of Wildlife, Parks and Tourism

KHEL Kansas Health and Environmental Laboratories

LCMS Liquid Chromatography Mass Spectrometry

OC KDHE, Secretary's Office

OHHABS One Health Harmful Algal Bloom System
OIT Office of Information Technology at KDHE

PIO Public Information Officer

PPE Personal Protective Equipment

PWS Public Water Supply or Public Water System (a local water producer)

PWSS Public Water Supply Section in BOW at KDHE

USACE U.S. Army Corps of Engineers

USBR U.S. Department of Interior, Bureau of Reclamation

WPMAS Watershed Planning, Monitoring and

Assessment Section in BOW at KDHE